PB-230 778

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES MASSACHUSETTS-RHODE ISLAND. PROCEEDINGS OF CONFERENCE HELD AT PROVIDENCE, RHODE ISLAND ON JANUARY 26, 1965

Public Health Service
Washington, D.C.

1965

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PB 230 778

CONFERENCE *on* POLLUTION *of the Interstate Waters of the* BLACKSTONE and TEN MILE RIVERS *and their Tributaries*

Massachusetts - Rhode Island

Convened on the Call of the
Secretary of Health, Education, and Welfare
Under Section 8 of the
Federal Water Pollution Control Act
(33 U.S.C. 466g et seq.)
Providence, Rhode Island
Tuesday, January 26, 1965

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Washington, D.C. 20201

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Conference in the Matter of Pollution of the Interstate Waters of the Blackstone and Ten Mile Rivers, Massachusetts-Rhode Island, and their Tributaries, held at the Veterans Administration Hospital Building, Providence, Rhode Island, on Tuesday, January 26, 1965, at 9:30 a.m.

PRESIDING:

Mr. Murray Stein, Chief, Enforcement Branch, Water Supply and Pollution Control, Public Health Service, Department of Health, Education, and Welfare, Washington, D. C.

CONFEREES:

Alfred E. Peloquin, Chief, Water Quality Section, Region I, Division of Water Supply and Pollution Control, Public Health Service, Department of Health, Education, and Welfare, Boston, Massachusetts

Walter J. Shea, Assistant Director of Health, in Charge Environmental Health Services, Rhode Island Department of Public Health

Worthen H. Taylor, Chief Engineer, Division of Sanitary Engineering, Massachusetts Department of Public Health

Francis J. LaRiviere, Executive Secretary, New England Interstate Water Pollution Control Commission

PARTICIPANTS:

Mrs. Ralph G. Anderton, representing the League of Women Voters of East Providence, Rhode Island

Honorable Cyril K. Brennan, Mayor of Attleboro, Massachusetts

Fred L. Corey, Director of Public Works of the City of Woonsocket, Rhode Island

John E. Graham, III, Esq., Attorney at Law, 1908 Industrial Bank Building, Providence, Rhode Island

Bryant L. Hopkins, Chairman, New England Interstate Water Pollution Control Commission

Eugene Jensen, Chief, Shellfish Sanitation Branch, Division of Environmental Engineering and Food Protection, Public Health Service, Department of Health, Education, and Welfare, Washington, D. C.

Kenneth M. Mackenthun, Aquatic Biologist, United States Department of Health, Education, and Welfare, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

Mrs. Ralph T. Salmi, representing the League of Women Voters of Massachusetts

Robert M. Schacht, representing Governor John H. Chafee of Rhode Island

Thomas A. Schrader, Chief, Division of Technical Services, United States Bureau of Sport Fisheries and Wildlife, Department of the Interior, Boston, Massachusetts

Gaston Warlop, President, Branch River Wool Combing Company, N. Smithfield, Rhode Island

PROCEEDINGS

OPENING STATEMENT

BY

MR. MURRAY STEIN

MR. STEIN: The conference is open.

Since the conferees are somewhat in the dark up here, I am going to go up to the lectern for the opening statement.

This conference in the matter of pollution of the interstate waters of the Blackstone River, the Ten Mile River, and their tributaries, involving the States of Massachusetts and Rhode Island, the New England Interstate Water Pollution Control Commission, and the Department of Health, Education, and Welfare, is being held under the provisions of Section 8 of the Federal Water Pollution Control Act.

The purpose of the conference is to bring together the State water pollution control agencies, the interested agencies involved, representatives of the Department of Health, Education, and Welfare, and other interested parties to review the existing situation, to appraise what progress has been made, to lay a basis for future action, and to give the States, localities, and industries an opportunity to take any remedial action which may be indicated under State and local law.

The conference technique is rather an old one. It is used informally by many State agencies in the normal conduct of their business in the field of water pollution control. The conference system was proposed by the United States Supreme Court as long ago as 1921 in the famous case of New York against New Jersey involving interstate pollution. I would like to quote briefly from this court opinion:

> "We cannot withhold the suggestion, inspired by the consideration of this case, that the grave problem of sewage disposal by the large and growing population living on the shores of New York Bay is one more readily to be most wisely solved by co-operative study and by conference and mutual concession on the part of representatives of the States so vitally interested in it than by proceedings in any court however constituted."

We strongly support the conference technique and we consider as successes those problems which are solved at the conference table, rather than in court.

Opening Statement - Mr. Stein

As specified in Section 8 of the Federal Water Pollution Control Act, the Secretary of Health, Education, and Welfare has notified the official State water pollution control agencies and interstate agencies of this conference. These agencies are the Massachusetts Department of Public Health, the Rhode Island Department of Health, and the New England Interstate Water Pollution Control Commission.

Massachusetts will be represented by Mr. Worthen H. Taylor; Rhode Island will be represented by Walter J. Shea, and the Commission will be represented by Francis J. LaRiviere.

Mr. Alfred E. Peloquin of the Boston Regional Office of the Department of Health, Education, and Welfare, the Regional Program Director for the water pollution control program, has been designated as conferee for the Federal Government.

My name is Murray Stein. I am from Washington, D. C., headquarters of the Department of Health, Education, and Welfare, and have been designated by the Secretary of Health, Education, and Welfare, Anthony J. Celebrezze, as Chairman of the Conference, and as his representative.

The representatives of the official agencies are privileged to invite whomever they wish to participate in these proceedings. However, this is a conference of State representatives, representatives of the Interstate Commission, and representatives of the Department of Health, Education, and Welfare, and these parties constitute the conferees.

Both the States and the Federal Government have responsibilities in dealing with interstate water pollution control problems. The Federal Water Pollution Control Act declares that the States have primary rights and responsibilities for taking action to abate and control interstate pollution. It has always been the policy of the Department of Health, Education, and Welfare to give full recognition to this traditional role of the States, and to encourage them in these activities. At the same time, the Department of Health, Education, and Welfare is charged by law with its own specific responsibilities in connection with interstate pollution control problems.

The Secretary of Health, Education, and Welfare is required to call a conference such as this when, on the basis of reports, surveys or studies, he has reason to believe that pollution subject to abatement under the Federal Water Pollution Control Act is occurring. The Act provides that pollution of interstate waters, whether the matter causing or contributing to such pollution is discharged directly into such waters or reaches such waters after discharge into a tributary of such waters, which endangers the health or welfare of persons in a State other than that in which the discharges originate, is subject to abatement. The conference will be useful, we hope, in providing a clear picture of the problem, in delineating the progress which has already been accomplished, and in indicating what still needs to be done to correct any problem which may exist in these interstate waters.

All the conferees will be called upon to make statements. The conferees, in addition, may call upon participants whom they have invited to the conference to make statements. At the conclusion of such statements, the conferees will be given an opportunity to comment or ask questions, and at the conclusion of the conferees' comments or questions I may ask a question or two. This procedure has in the past proven effective in reaching equitable solutions.

At the end of all the statements, we will have a discussion among the conferees and try to arrive at a basis of agreement on the facts of the situation. Then we will attempt to summarize the conference orally, giving the conferees, of course, the right to amend or modify the summary.

Under the Federal law, the Secretary is required at the conclusion of the conference to send a summary of it to all the conferees. The summary, according to law, must cover the following points:

1. Occurrence of pollution of interstate waters subject to abatement under the Federal Act;

2. Adequacy of measures taken toward abatement of pollution; and

3. Nature of delays, if any, being encountered in abating the pollution.

The Secretary is also required to make recommendations for remedial action if such recommendations are indicated.

Now a word about the procedure governing the record of the conference. A verbatim transcript will be made of the conference by Mr. Al Zimmer. Mr. Zimmer is making this transcript report for the purposes of aiding us in preparing a summary and of providing a complete record of what is said and introduced here. We will make copies of the summary and transcript available to the official State water pollution control agencies of Massachusetts and Rhode Island, and to the Interstate Commission. We have found that, generally, it is best that people should request transcripts through their State agency, rather than come directly to the Federal Government. The reason for this is that we would prefer the people who are interested in the problem to follow their normal relations in dealing with State agencies rather than the Federal Government on these matters when the conference has been concluded. We will be most happy to make this material available to the States for distribution.

I would suggest that all speakers and participants other than the conferees making statements come to the lectern and identify themselves for purposes of the record.

At this point, we would like to call on the representative of the Governor of Rhode Island, Mr. Robert M. Schacht, who will represent the Governor.

Mr. Schacht, I would suggest it would facilitate producing of the transcript if any person having a statement would give an extra copy of that to the reporter at least before making the statement. It does get to be quite a chore by the end of the day to take all this material down in a verbatim manner, and it would ease the situation considerably if this should be followed. Thank you.

Mr. Schacht.

STATEMENT OF ROBERT M. SCHACHT, REPRESENTING GOVERNOR JOHN H. CHAFEE OF RHODE ISLAND

MR. SCHACHT: Thank you, Mr. Chairman.

Members of the conference:

Governor Chafee sends his greetings to you and has given me the following statement to read into the record:

The State of Rhode Island is greatly concerned in restoring the condition of its rivers to the highest level, consistent with current knowledge of the means of sewage and waste treatment and the essential uses to which they must be put. The State is particularly concerned with interstate streams such as the Blackstone and Ten Mile because of their relatively large flow, and because of their importance to the economy of the State.

The State of Rhode Island was one of the first New England States to pass laws providing for the State's participation in the New England Interstate Water Pollution Control Compact. This compact is intended to provide the means to coordinate the action of neighboring States in bringing about the control of pollution of interstate streams. The water pollution control accomplishment under this compact has been substantial.

The Federal Government is now playing an important role in stream pollution abatement through research in treatment methods and by granting financial assistance to municipalities in the construction of sewage treatment facilities. It is believed that through such teamwork with the States the greatest accomplishment in the shortest time will be realized, while the primary interests of the States in the rivers flowing through them will be maintained.

It is hoped that this conference on the Blackstone and Ten Mile Rivers will lead to a better understanding of the remaining water pollution problems that exist in these river basins and will hasten the finding of solutions to them.

Thank you very much.

MR. STEIN: Thank you, Mr. Schacht.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, thank you very much for your statement from the Governor.

I have just a few brief announcements before we do get started.

I understand the rules are no smoking in the auditorium, and I guess if I can stand it, the rest of you can.

I think most of you know that I am an inveterate smoker. It probably will do us all a lot of good.

The next point, as I understand it, is that the dining facilities are relatively limited here. If we break at 12:45, there may be some limited facilities downstairs. I understand they just have room for serving fifty. We will try, though, to have an adequate break so that we can get something to eat and get back this afternoon, hopefully giving you time, if transportation can be arranged, to get downtown, get something to eat, and then get back.

At this point I would like to call on Mr. Peloquin for the presentation of the Federal Department.

Mr. Peloquin.

STATEMENT OF ALFRED E. PELOQUIN, CONFEREE AND CHIEF, WATER QUALITY SECTION, REGION I, DIVISION OF WATER SUPPLY AND POLLUTION CONTROL, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, BOSTON, MASSACHUSETTS

MR. PELOQUIN: Mr. Chairman, fellow conferees, ladies and gentlemen:

I am very appreciative of the opportunity to be here today as a Federal conferee in this matter dealing with the water quality of the interstate waters of the Blackstone and Ten Mile Rivers.

The importance of water quality has been and continues to be very much a matter of concern for many people. On a regional basis the importance of water quality was dramatically and economically driven home by the severe drought of the past two years. The qualitative shortage of water in the region created many hardships, problems, and expenditures, and for a time, posed the threat of industrial shutdowns due to a lack of good-quality water.

Congress, by passage of and by appropriations for the Federal Water Pollution Control Act (Public Law 660), has shown concern and urgency in pollution matters of the country as a whole. This concern is also evidenced by the recent introduction of Senate Bill S. 4 by Senator Muskie and twenty-five others for consideration by the 89th Congress.

I might add that among the twenty-five others are Senators Kennedy of Massachusetts, Ribicoff of Connecticut, and Pell of Rhode Island.

Three similar bills were introduced into the House of Representatives by Congressmen Rodino of New Jersey, Dingell of Michigan, and Madden of Indiana.

We are here this morning because of one of the provisions of Public Law 660, namely, the enforcement section. There are other provisions in this Act currently working in this area. Our construction grants program has made nearly $2 million available to six communities in these two river basins for construction of municipal sewage treatment works, municipal works costing an estimated $4.7 million. As of December 31, 1964, the Commonwealth of Massachusetts has received over $11 million towards construction of facilities estimated to cost $51 million and Rhode Island has received over $4 million towards facilities costing nearly $19 million.

The Federal Government has, in Public Law 660, authorization to provide grants to State and interstate agencies to extend and to expand their water pollution control programs. There are provisions for research on water pollution matters, not only on a contract basis, but on a grant basis to universities, colleges, and from our own Sanitary Engineering Center at Cincinnati, Ohio.

Complete and accurate information on existing conditions is essential to any program of water pollution control or water resources planning. For this reason operation of water pollution surveillance stations and periodic inventories of municipal water supply and waste treatment facilities are supported under the Basic Data Section of the Division of Water Supply and Pollution Control.

Under Public Law 660 all Federal installations are charged with the responsibility "to cooperate with the Department of Health, Education, and Welfare and any State or interstate agency or municipality having jurisdiction over waters into which any matter is discharged from such water, in preventing or controlling pollution of such waters." The Regional Program Director of the Division of Water Supply and Pollution Control, has the primary responsibility for providing any necessary inter-agency liaison, arranging for technical assistance necessary to solve unique waste disposal problems, and generally assuring that Federal installations should set an example in the abatement of water pollution.

The Federal Water Pollution Control Act provides for technical services in the form of scientific and technical consultation and assistance in complex and sophisticated waste problems. The Act also provides for the establishment of field laboratories and research facilities, one of which will be located in Boston, to consider regional water problems. Assistance from our various technical staffs is now available to industry, municipalities, State and interstate agencies upon request through the State or interstate water pollution control agencies. Assistance through the Northeast Laboratory will be available when that facility becomes operational in early 1967.

Finally, the Federal Water Pollution Control Act provides for the development of a comprehensive program, jointly with State agencies, with Federal agencies, and with industries and municipalities which are concerned.

As I stated earlier, I appreciate the opportunity of being here today, first of all, because I am working and participating in what I believe is an urgent and important program; secondly, because of the pleasant relationships we have had with municipal, State and interstate officials and representatives of industry and the general public on the various parts of our other programs; and, lastly, I am happy to be here because we in the Division of Water Supply and Pollution Control have interests and goals in common with State and interstate pollution control agencies, that is, the resolution of waste treatment problems and the abatement of pollution.

For the Department of Health, Education, and Welfare, and in behalf of the Regional Program Director for Region I, I pledge the support of our staff in working towards clean water in the Blackstone and Ten Mile River Basins.

To outline for you, on the part of the Department of Health, Education, and Welfare, the picture of water use and water pollution problems in these two river basins, our technical staff at the Sanitary Engineering Center at Cincinnati has prepared a report from available information and field studies on the rivers. This will be given to the recorder, and Mr. Kenneth M. Mackenthun, Aquatic Biologist of the Technical Services Branch at the Sanitary Engineering Center, will review the salient points set forth in this report.

Mr. Mackenthun.

STATEMENT OF KENNETH M. MACKENTHUN, AQUATIC BIOLOGIST, UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO

MR. MACKENTHUN: Mr. Chairman, I have submitted a copy of the report on pollution of the interstate waters of the Blackstone and Ten Mile Rivers, Massachusetts-Rhode Island, and request that it be entered as an exhibit in this conference.

MR. STEIN: Do you want it entered as an exhibit in the record, or entered as if read into the record?

MR. MACKENTHUN: Entered in the record as read.

MR. STEIN: Without objection, that will be done.

MR. MACKENTHUN: On the basis of reports, surveys, or studies, having reason to believe that pollution from sources in Massachusetts and Rhode Island was endangering the health or welfare of persons in Rhode Island and Massachusetts, and in accordance with Section 8 of the Federal Water Pollution Control Act, the Secretary of Health, Education, and Welfare called a conference of the State and interstate water pollution control agencies and the Department of Health, Education, and Welfare in the matter of pollution of the interstate waters of the Blackstone and Ten Mile Rivers and their tributaries.

This report on pollution of the interstate waters of the Blackstone and Ten Mile Rivers is based on: previous reports; data and other materials obtained from the Massachusetts Department of Public Health, the Rhode Island Department of Health, the New England Interstate Water Pollution Control Commission, and the U. S. Geological Survey; information furnished by other interested Federal, State and local agencies and individuals; official records of the Public Health Service; and data obtained by the Public Health Service through field studies conducted during March and August 1964. Woonsocket, Rhode Island, furnished a site and utility service for the mobile laboratories at their municipal water works.

Mr. West will show the figures on the screen at the rear. These figures are the same as those appearing in the report, with the exception of Figures 2, 3, 4 and 5, which illustrate waste sources and are different from those shown in the report in the matter of scaling.

These figures shown during the discussion will be reproduced in black and white for the transcript.

THE AREA

The Blackstone River (Figure 1*) begins at the American Steel and Wire Company Dam in the southern part of Worcester, Massachusetts. Above this point for a distance of 3.3 miles, it is known as the Middle River, which receives tributaries from the north, east, and south. The Blackstone River flows in a southeasterly direction for 42 miles to Pawtucket, Rhode Island, then southerly for 7 miles to its mouth at the Seekonk River. In its upper 28 miles, the river flows through Massachusetts, receiving the Mumford and West Rivers near Uxbridge. It enters Rhode Island for about one mile, receives the Branch River, which is a Rhode Island tributary, and loops back into Massachusetts. After another short loop of less than a mile, the Blackstone returns to Rhode Island at Woonsocket, Rhode Island. The lower 21 miles flows through Rhode Island.

* Sampling Station Identifications (Table 1), Blackstone River Sampling Locations (Figure A), and Ten Mile River Sampling Locations (Figure B) are included in the Appendix.

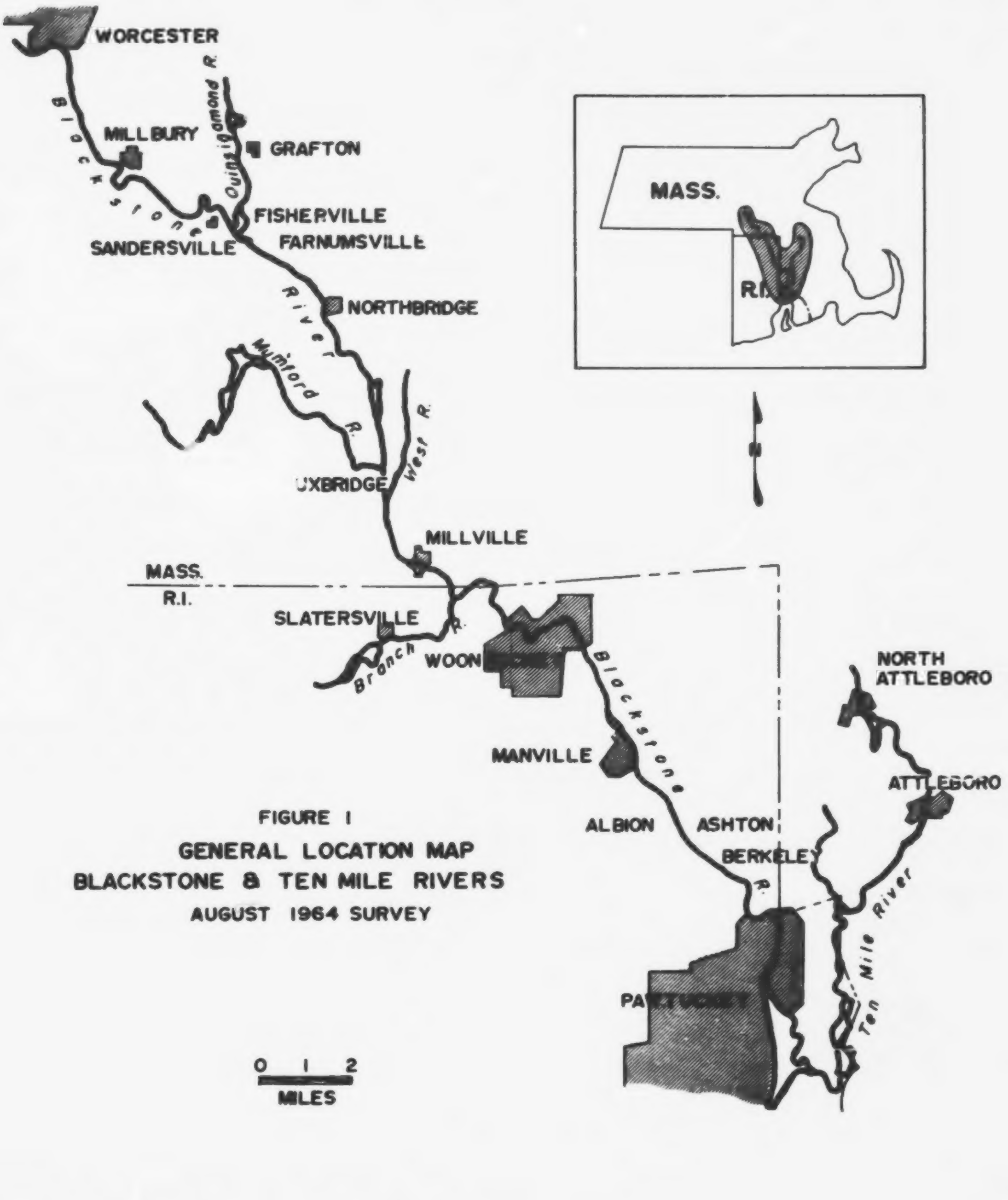

WORCESTER
Blackstone
MILLBURY
Quinsigamond R.
GRAFTON
FISHERVILLE
SANDERSVILLE
FARNUMSVILLE
River
NORTHBRIDGE
Mumford
R.
West R.
UXBRIDGE
MILLVILLE
MASS.
R.I.
SLATERSVILLE
Branch R.
WOON
Blackstone
MANVILLE
ALBION
ASHTON
BERKELEY
R.
NORTH ATTLEBORO
ATTLEBORO
Ten Mile River
PAWTUCKET
MASS.
R.I.
N
0 1 2
MILES

FIGURE 1

GENERAL LOCATION MAP
BLACKSTONE & TEN MILE RIVERS
AUGUST 1964 SURVEY

The Blackstone River drains an area of 540 square miles; its fall averages about 10 feet per mile. Formerly it tumbled over many rocky rapids. Today these have long been buried beneath impoundments to create power. The first use of the water power of the Blackstone River took place in 1671 and by the early 1700's many grist and sawmills were furnished power by low head dams in the basin. Some of these dams have been abandoned, but more than 30 still exist.

The area considered by this report includes the main stem of the Blackstone River and portions of its major tributaries: the Branch River, in Rhode Island, and the Mumford River and the West River, in Massachusetts. The Branch River, with a drainage area of 96 square miles, is the largest tributary in the Blackstone River Basin. It receives industrial wastes and sewage from plant employees in Rhode Island and joins the Blackstone River in Rhode Island immediately before the Blackstone returns to Massachusetts for a short distance prior to its re-entry to Rhode Island. The Mumford River flows from the outlet of Manchaug Pond in Sutton, Massachusetts, and flows in a general easterly direction for 13.3 miles to its confluence with the Blackstone River near Uxbridge, Massachusetts. In this distance it receives sewage and industrial wastes from the surrounding area. After flowing southerly for 16 miles, the West River joins the Blackstone River 0.6 miles downstream from the confluence of the Mumford and Blackstone rivers. The West River receives industrial wastes and sewage from plant employees.

Previous reports, some dating back to the early 1900's, have described the Blackstone River as "little more than an open sewer" and one of the most polluted rivers in Massachusetts. Its crystal clear headwaters are impounded by a series of dams, forming reservoirs that furnish the water supply for the city of Worcester. Below Worcester, however, it is the recipient of sanitary wastes, as well as wastes arising from industrial operations, such as: wool scouring, wool dyeing and finishing, pickling liquors, rubber processing, and paper coating.

This report also considers the entire drainage of the Ten Mile River in Massachusetts and Rhode Island. Ten Mile River (Figure 1) begins at the outlet of a pond in the northwest part of Plainville, Massachusetts. It follows an irregular course for a distance of 20.8 miles: first generally southeast 8.3 miles to Attleboro, Massachusetts, and then generally south-southwest 12.5 miles to Rumford, in East Providence, Rhode Island, where it joins the Seekonk River 2.5 miles above its mouth. It first enters Rhode Island near the northeast corner of the State and after about 0.2 of a mile returns to Massachusetts. After another 0.2 of a mile in Massachusetts, it re-enters Rhode Island, and continues to its junction with the

Seekonk. It has a fall that averages 11 feet per mile and a drainage area of 54 square miles.

The Ten Mile River at one time was stocked with brook trout at Attleboro, Massachusetts. Currently, however, it is considered too polluted to be stocked with any fish below its headwaters near Plainville, Massachusetts. It receives municipal wastes, as well as plating, pickling, chemical, and textile wastes.

On September 24, 1958, the New England Interstate Water Pollution Control Commission approved the classification recommendations for the Blackstone River as submitted jointly by the States of Massachusetts and Rhode Island. The basis for these recommendations was the "Tentative Plan for Classification of Waters" adopted by the Commission, of which both States are signatory members. This Plan was revised and formally adopted as of October 1, 1959, and the water quality requisites for each classification are described in Table 42.

At the time of classification the condition of the Blackstone River from Fisherville, Massachusetts, to Woonsocket, Rhode Island, was Class D with proposed upgrading to Class C. From Worcester to Fisherville, Massachusetts, and from Woonsocket to Sneech Brook in Rhode Island, the river was designated Class E or nuisance condition (see footnote to Table 42). The proposed highest use classification upgrades the water quality in the upper reach from Worcester to Fisherville to Class D, in the lower reach from Woonsocket to

Manville to Class C, and from Manville to Sneech Brook to Class B. From Sneeck Brook to tidewater at Pawtucket, the river was rated Class D and called for upgrading to Class B from Sneech Brook to Lonsdale and to Class C below Lonsdale and through Pawtucket.

The uses for which Class D water quality are suitable are ". . . transportation of sewage and industrial wastes without nuisance and for power, navigation, and certain industrial uses."

Class C water quality is described as being ". . . suitable for recreational boating; irrigation of crops not used for consumption without cooking; habitat for wildlife and common food and game fishes indigenous to the region; industrial cooling and most industrial process uses." Among other requirements, Class C waters shall have not less than 5 parts per million of dissolved oxygen. Oil, grease, color, and turbidity shall not be objectionable, and there shall be no odor, scum, floating solids, debris, and sludge deposits. No limiting values have been established for bacterial pollution.

Branch River has been determined to be Class D on the basis of present water quality from Slatersville Reservoir to its confluence with the Blackstone River. It has been assigned a future highest use classification of C in this reach.

Ten Mile River has been determined to be Class D on the basis of present water quality from the North Attleboro, Massachusetts, sewage treatment plant to the East Providence, Rhode Island, water supply reservoir. In June 1956 the New England Interstate Water Pollution Control Commission assigned a highest use classification for this reach of the Ten Mile River as Class C. The classification system of the NEIWPCC is set forth in Table 42.

WATER USES

MUNICIPAL USE

East Providence, Rhode Island, obtains its water supply from the East Providence Reservoir situated on Ten Mile River. The system serves 42,000 consumers. Taste and odor problems have been reported. The Rhode Island Department of Health has recommended that this source be abandoned because of pollution. On June 9, 1964, the residents of East Providence voted in favor of a $7 million bond issue to obtain a safe water supply from the Providence municipal system.

INDUSTRIAL WATER SUPPLY

The Blackstone and Ten Mile rivers provide process water to industry and are used for wooling, water power, and fire protection.

RECREATION

Water-related recreational activities have increased rapidly on a national scale, especially near centers of population. The immeasurable aesthetic values that an unpolluted waterway supplies are very important assets of adjacent metropolitan areas. As indicated below, these considerations have little relevance to the Blackstone and Ten Mile rivers, whose usefulness for recreation has been greatly damaged by pollution caused by domestic and industrial wastes.

Fishing

The Blackstone River once supported a notable run of American shad that was destroyed at an early date by the construction of dams. Presently, all fishery pursuits are severely limited by pollution. The main stem is practically uninhabitable for fish. A few fish, mostly carp and suckers, are taken from the river. When pollution is abated, the Blackstone River will be repopulated naturally by warm water species of fish. At present, because of pollution, there are no plans to develop a fishery. Trout, which are stocked in Lake Quinsigamond during the spring of each year, provide sport fishing for about 30 days after the fish are released. Fisherville Pond near Fisherville, Massachusetts, is also reported to provide fishing.

Ten Mile River is also stocked with about 800 brook trout at Plainville, Massachusetts, during the spring of each year. The condition of the water is such that in all probability a game fish population could not be supported. When pollution is abated, there is a distinct probability that warm water species will repopulate naturally without restocking.

In both the Blackstone and Ten Mile rivers, a suitable warm water fish population would develop if gross pollution did not exist.

Seining of golden shiners for bait-fish is carried out on the Blackstone River from Woonsocket to Pawtucket, Rhode Island.

Other Recreational Pursuits

Some canoeing activity is reported on the Blackstone River. However, physical difficulties are present that require many portages.

Lake Quinsigamond and other nearby ponds are used for boating, swimming, water skiing, and other water sports. Where there is suitable water, some of the people who live near the stream, and some who visit the river to enjoy being near water will swim on an unorganized basis. Although no bathing beaches were observed on the main stems, the Blackstone and Ten Mile rivers undoubtedly are no exception to this generalization.

NAVIGATION

The Blackstone River has not been used for navigation since abandonment of the barge canal in 1848.

HYDROPOWER

The Blackstone and Ten Mile rivers have been used for power purposes since shortly after settlement began. Thirteen hydroelectric plants on the Blackstone River use 200 feet of the total fall of 439 feet and have a total installed capacity of 6,500 kilowatts.

SOURCES OF WASTES

The most significant types of wastes in the Blackstone River drainage area are municipal sewage and woolen textile wastes. In the Ten Mile River drainage area, wastes include municipal sewage and woolen textile wastes, chemical process wastes, and metal plating wastes.

With the exception of the chemical and metal plating wastes, the principal pollutional constituents of the wastes may be expressed in terms of 5-day biochemical oxygen demand (BOD), suspended solids, and coliform bacteria. Biochemical oxygen demand, or BOD, is the measure of the amount of organic matter oxidized through biochemical processes. A high BOD generally indicates the presence of a large amount of organic material.

Suspended solids are solids mixed with and generally imparting a cloudy appearance to water, sewage, or other liquids, and may settle out to create objectionable flood banks on the stream bottom.

In tables in the Appendix, waste characteristics are presented in population equivalents of these three constituents. One population equivalent is that quantity of the constituent that would be contained in the raw sewage produced by one person in one day. For example, a waste containing one population equivalent each of oxygen-demanding material (BOD), suspended solids, and coliform bacteria, would contribute one/sixth pound of 5-day BOD, one/fifth pound of suspended solids and 400 billion coliform bacteria to the receiving waters.

Data on sewage and industrial waste characteristics are presented in Tables 2 through 5 of the Appendix. Much of the data is based on sampling and analyses of the wastes, but in some cases reasonable estimates have been made on the basis of population served by sewers.

BACTERIA

Sewage is the principal source of bacterial pollution in the Blackstone River.

Blackstone River

Table 2 lists the sources and characteristics of municipal sewage discharged to the Blackstone River and tributaries between Worcester, Massachusetts, and Central Falls, Rhode Island. The relative bacterial contributions of the individual sources are shown in Figure 2. Of the 12 jurisdictions listed, 7 are in Massachusetts and 5 are in Rhode Island. Eighty (80) percent of the population served by municipal sewers resides in Massachusetts. The 180,000 sewered population in Worcester represents 76 percent of the total. Twenty (20) percent of the sewered population resides in Rhode Island. Woonsocket, with a 45,000 sewered population, represents 19 percent of the total.

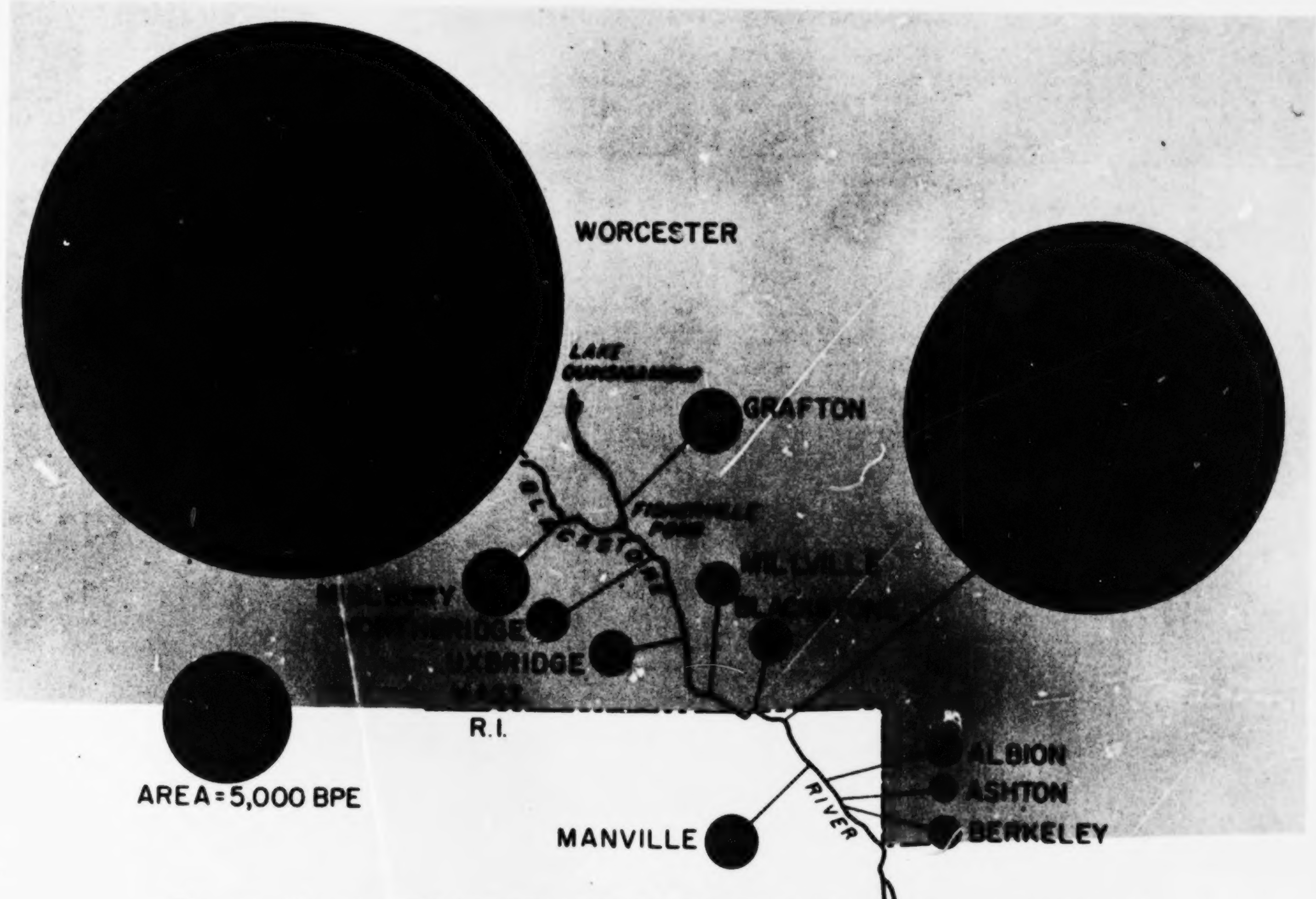

WORCESTER
LAKE
GRAFTON
BLACKSTONE
UXBRIDGE
R.I.
ALBION
ASHTON
BERKELEY
MANVILLE
RIVER
AREA=5,000 BPE

Figure No. 2. SOURCES OF SEWAGE ESTIMATED BACTERIAL POPULATION EQUIVALENTS (BPE) BLACKSTONE RIVER AUGUST 1964 SURVEY

Worcester and Northbridge, Massachusetts, provide secondary sewage treatment. Woonsocket, Rhode Island, discharged raw sewage to the river while rehabilitating and constructing additions to their treatment plant during the August 1964 survey. The other 9 jurisdictions, which have no sewage treatment, discharge raw sewage directly to the river. Four (4) of the 9 have no sanitary sewer systems; the sources being private sewer outlets and connections to private storm drains.

Of the 140,000 total BPE entering the Blackstone River, 67 percent originates in Massachusetts and 33 percent in Rhode Island.

Worcester, Massachusetts, is the single largest source of coliform bacteria. Sanitary sewage from Worcester is treated in an inadequate overloaded secondary treatment plant, which lacks proper sludge digestion facilities and does not provide chlorination for effluent disinfection. The effluent contained approximately 90,000 BPE, which amounted to 64 percent of the total coliform bacterial load entering the Blackstone River.

Woonsocket, Rhode Island, discharging 45,000 BPE in raw sewage, contributes 32 percent of the total. It was the second largest single source of coliform bacteria. All raw sewage from Woonsocket bypassed the treatment plant and entered the river without treatment during the August 1964 survey. Construction of new primary treatment and effluent chlorination facilities and the rehabilitation of existing secondary treatment units were nearing completion during August. When completed, the total 5.0 million gallons per day (mgd) of Woonsocket domestic sewage will receive primary treatment, approximately 3.5 mgd of the primary effluent will receive standard rate activated sludge type secondary treatment, and all effluents will be chlorinated. The pollutional loading, including coliform bacteria, entering this reach of the river should be greatly reduced when the expanded Woonsocket sewage treatment plant is completed and placed in full operation.

Coliform bacteria in the sewage discharges from the other 10 jurisdictions listed in Table 2 amounted to 5,400 BPE, or 4 percent of the total. Individual loads from these 10 jurisdictions ranged from 1,200 BPE (0.9 percent of total) at Millbury to 140 BPE (0.1 percent of total) at Ashton.

Bacterial pollution is discharged from industrial plants, as well as in the sewage from plant employees. Table 4 lists estimated bacterial loads from these sources. The total BPE from all industrial plants is estimated to be 1,750, with 53 percent occurring in Massachusetts and 47 percent in Rhode Island.

Ten Mile River

Attleboro and North Attleboro are the two sources of municipal sewage discharged to Ten Mile River between Plainville, Massachusetts, and the confluence of the Ten Mile with the Seekonk River in East Providence, Rhode Island. Both of these (Table 3 - Appendix) are in Massachusetts. The total estimated BPE from both sources is 2,105, with 2,100 BPE, or practically 100 percent from Attleboro.

The North Attleboro sewage treatment plant includes primary settling tanks and separate sludge digestion high rate trickling filters and secondary sedimentation, sand filters and effluent chlorination facilities. During the August 1964 survey, effluent from the secondary clarifiers was applied to the slow sand filters and this filter effluent was chlorinated before it entered Ten Mile River. The low coliform density in the final effluent attests to the effectiveness of disinfection by chlorination.

In Attleboro, additional primary treatment facilities, new high rate trickling filter secondary treatment units, and chlorination facilities will supplement the original sand filter plant. Construction of these facilities was nearing completion during the August 1964 survey. During much of the survey period, raw sewage was bypassed around the primary units, applied directly on to the sand filters, and the filter effluent entered the river without chlorination. The pollution loading, including coliform bacteria, from this source should be significantly reduced when the new treatment facilities are placed in operation.

The sewage from industrial plant employees (Table 5 - Appendix) contributes a combined bacterial load of 321 BPE. Of this, 95 percent is in Massachusetts, and 5 percent is in Rhode Island.

BIOCHEMICAL OXYGEN DEMAND (BOD)

Blackstone River

The estimated oxygen demand population equivalents of municipal sewage discharged to the Blackstone River are given in Table 2 and those of industrial wastes discharging directly to the river in Table 4.

The total from all sources of sewage is 93,000 PE, with 50 percent from Massachusetts and 50 percent from Rhode Island. Raw sewage from Woonsocket (Figure 4) contained the largest load, with 48 percent of the total, and the Worcester sewage treatment plant effluent is second, with 43 percent. Other sources, accounting for the remaining 9 percent, ranged from 0.2 to 2.7 percent of the total each, with the effluent from the Northbridge, Massachusetts, sewage treatment plant being responsible for the higher figure.

The oxygen demand of industrial wastes, listed in Table 4, exceeded that of the sewage discharges that entered the Blackstone River. The total oxygen demand from all sources is 126,000 PE, with 35 percent from Massachusetts and 65 percent from Rhode Island. The heaviest industrial load enters the river at Woonsocket (Figure 5) where 8 of 10 unnamed plants, not served by the municipal sewers, account for 46 percent of the total from all sources. No estimates are available for 2 of the 10. The second heaviest load, 14 percent of the total, reaches the Blackstone through the Branch River from the Branch River Wool Combing Company, Incorporated, in Branch Village, Rhode Island. As noted previously, the Branch River enters the Blackstone in the one-mile reach which loops from Massachusetts into Rhode Island and back into Massachusetts. The third and fourth largest sources are the Hayward-Schuster Woolen Mills, Incorporated, on the Mumford River in Massachusetts, with 10 percent of the total, and the Felters Company, in Millbury, Massachusetts, with 8 percent.

Approximately 20 percent of the total load is discharged by the following seven industries:

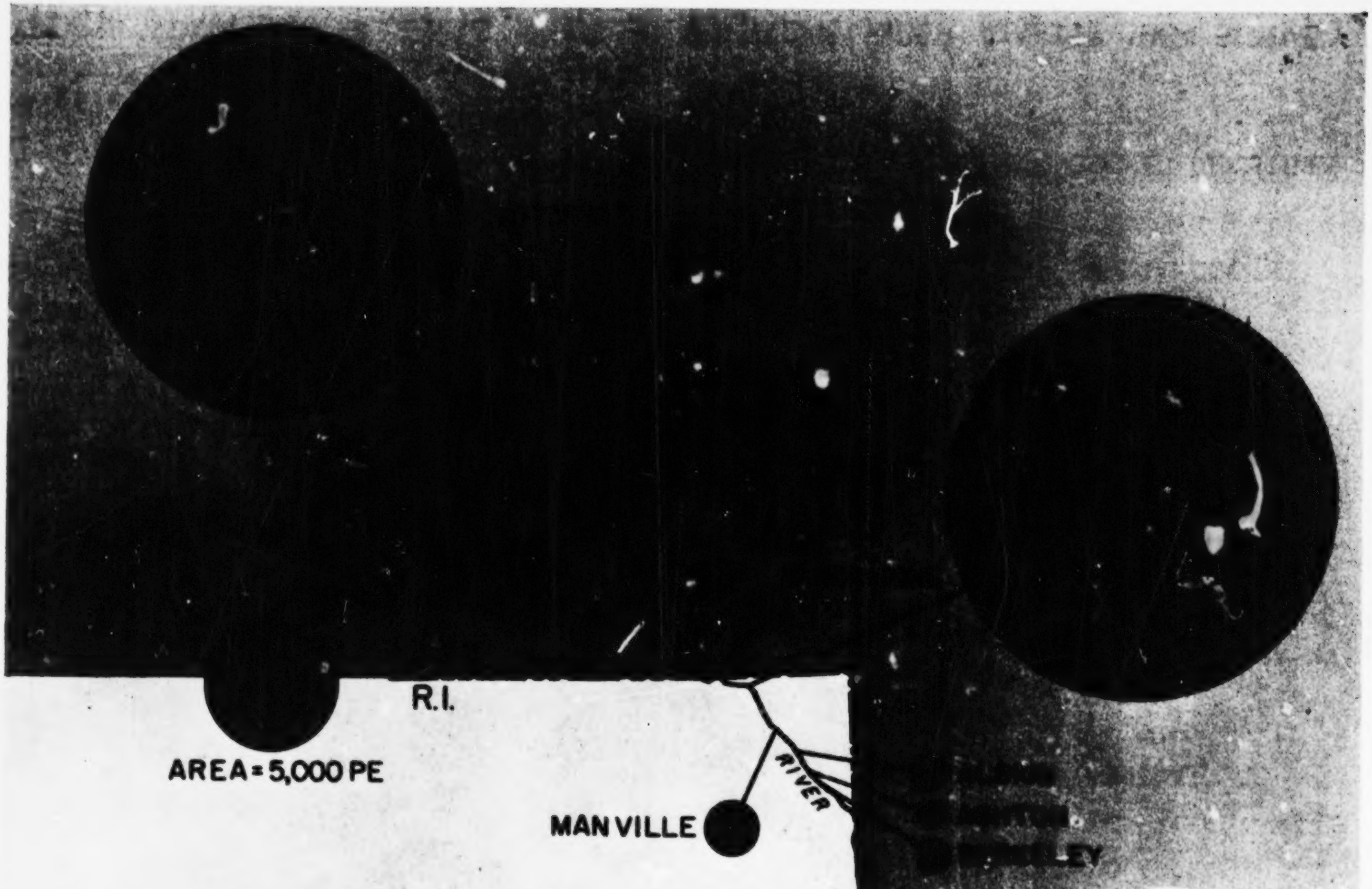

R.I.
AREA = 5,000 PE
RIVER
MANVILLE

Figure No. 4. SOURCES OF SEWAGE ESTIMATED OXYGEN DEMAND POPULATION EQUIVALENTS (PE) BLACKSTONE RIVER AUGUST 1964 SURVEY

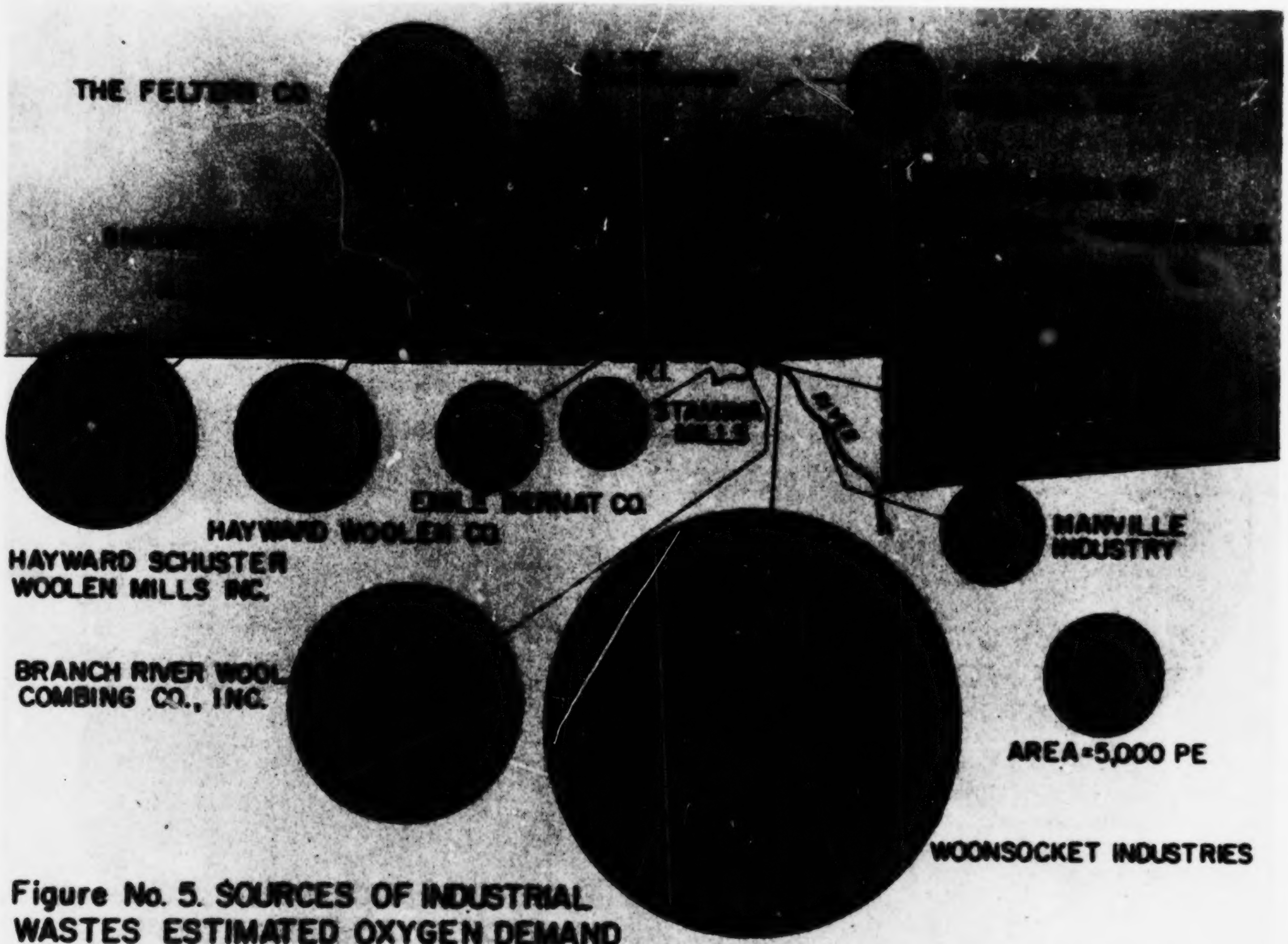


Figure No. 5. SOURCES OF INDUSTRIAL
WASTES ESTIMATED OXYGEN DEMAND
POPULATION EQUIVALENTS (PE) BLACKSTONE RIVER AUGUST 1964 SURVEY

Hayward Woolens	5%	of the total
Stanley Woolen Mills	4%	"
Emile Bernat Co.	3%	"
Manville Industries	3%	"
J. J. O'Donnell Woolens	2%	"
Stamina Mills	2%	"
W. & S. Laundry	1%	"

Six other industries, shown in Table 4 and Figure 5, discharging from 0.2 percent to 0.6 percent each, contributed approximately 2 percent of the total industrial waste load.

The total PE from sewage and industrial wastes discharged to the Blackstone River in both Massachusetts and Rhode Island is 219,000. Of this, 42 percent originates in Massachusetts and 58 percent in Rhode Island. Sewage accounts for 42 percent of the total, and industrial wastes for 58 percent.

Ten Mile River

Waste discharges from four industries (Table 5) and the effluent from two municipal sewage treatment plants (Table 3) are responsible for the oxygen-demanding material discharged to Ten Mile River.

As illustrated on Figure 3, more than half of the total load is discharged from the Thompson Chemical Co. The second and third largest loads are contained in the effluent from the Attleboro Dyeing and Finishing Corporation holding ponds (15% of total) and the effluent from the Attleboro sewage treatment plant (14% of total). Dodgeville Finishing Company (6%), Pawtucket Dyeing and Bleaching (5%), and the North Attleboro sewage treatment plant (2%) are responsible for the remaining 13 percent of the total load.

Five of these six sources of oxygen-consuming wastes are located in Massachusetts. The Pawtucket Dyeing and Bleaching plant is physically located in Rhode Island, but the effluent from their industrial waste holding ponds enters the Massachusetts section of a loop in Ten Mile River where the river flows from Rhode Island into Massachusetts and then back again into Rhode Island.

The total PE of sewage and industrial wastes

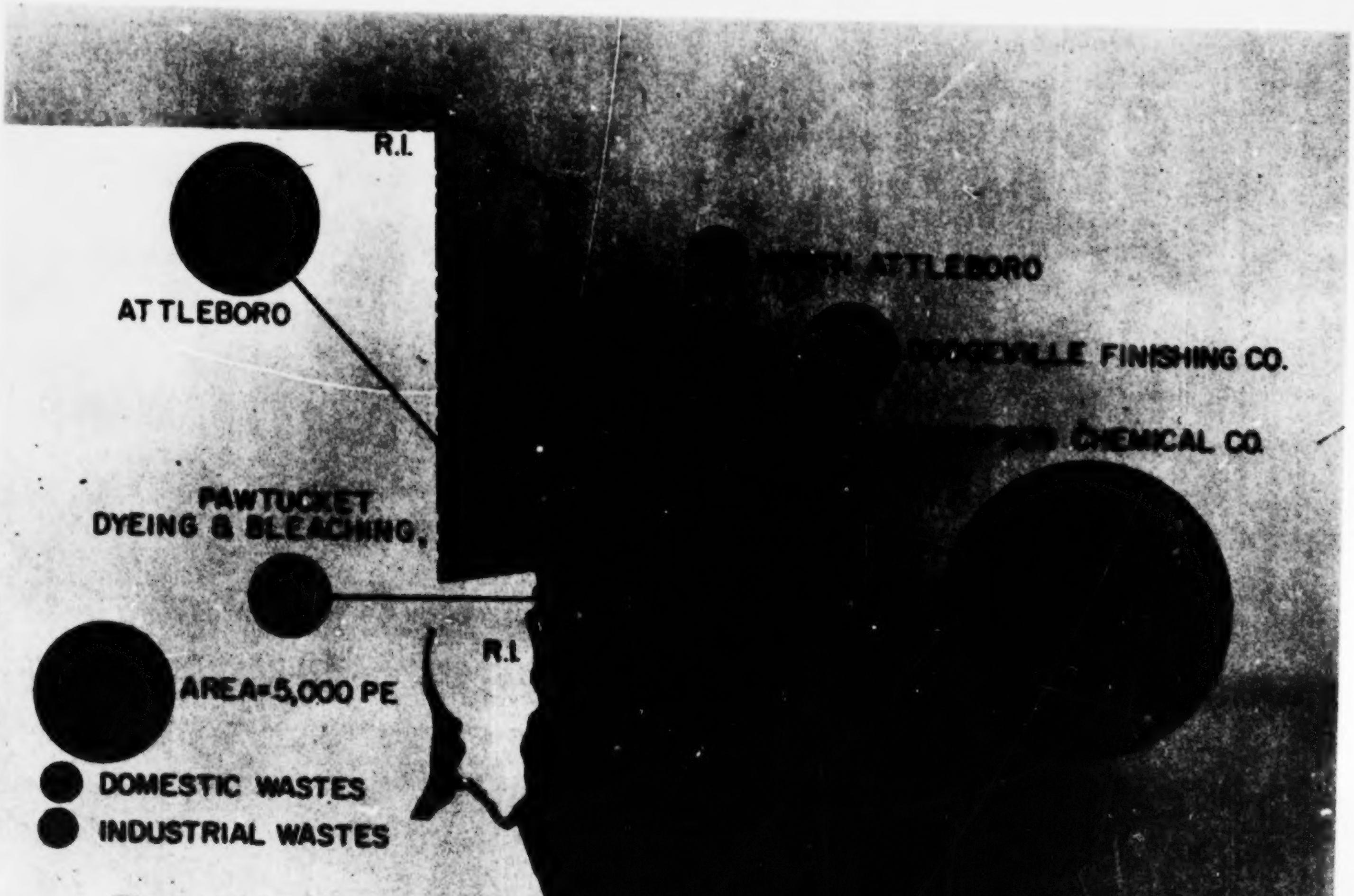

R.I.
ATTLEBORO
ATTLEBORO
FINISHING CO.
CHEMICAL CO.
PAWTUCKET
DYEING & BLEACHING,
R.I.
AREA=5,000 PE
DOMESTIC WASTES
INDUSTRIAL WASTES

Figure No. 3. SOURCES O
ESTIMATED OXYGEN DEM
(PE) TEN MILE RIVE

discharged to the Ten Mile River in both Massachusetts and Rhode Island (Figure 3) is 37,800, of which 95.0 percent originates in Massachusetts and 5.0 percent in Rhode Island. Sewage accounts for 17 percent of the total and industrial wastes for 83 percent.

SUSPENDED SOLIDS

Blackstone River

The suspended solids population equivalents (SSPE) of municipal sewage discharged to the Blackstone River are given in Table 2. The total from all sources is 99,000, of which 53 percent originates in Massachusetts and 47 percent in Rhode Island. Worcester is the largest source, with 49 percent of the total, and Woonsocket is second, with 45 percent. The other 10 sources, listed in Table 2, contribute the remaining 6 percent of the total.

Industrial wastes contribute 61,300 SSPE's, with 24 percent discharged in Massachusetts and 76 percent in Rhode Island. Here, again, 8 of the 10 unnamed industries not served by the municipal sewers in Woonsocket discharge approximately one-half of the total, and the Branch River Wool Combing Company, Incorporated, plant is the largest of the individual contributors, with 24 percent of the total.

Hayward-Schuster Woolen Mills, Incorporated, on the Mumford River, is third, with 11 percent of the total. The other 15 plants, shown in Table 4, are responsible for the remaining 16 percent of the total suspended solids loading for the Blackstone River.

The total SSPE of sewage and industrial waste discharged to the Blackstone River in both Massachusetts and Rhode Island is 160,300, of which 42 percent originates in Massachusetts and 58 percent in Rhode Island. Of the total, 62 percent is from sewage and 38 percent is from industrial wastes.

Ten Mile River

The Ten Mile River receives a total SSPE of 6,200 from municipal sewage and industrial wastes (Tables 3 and 5) in Massachusetts and Rhode Island. Ninety (90) percent of this originates in Massachusetts, and 10 percent in Rhode Island. Fifty-one (51) percent is from municipal sewage and 49 percent from industrial wastes.

METAL PLATING WASTES

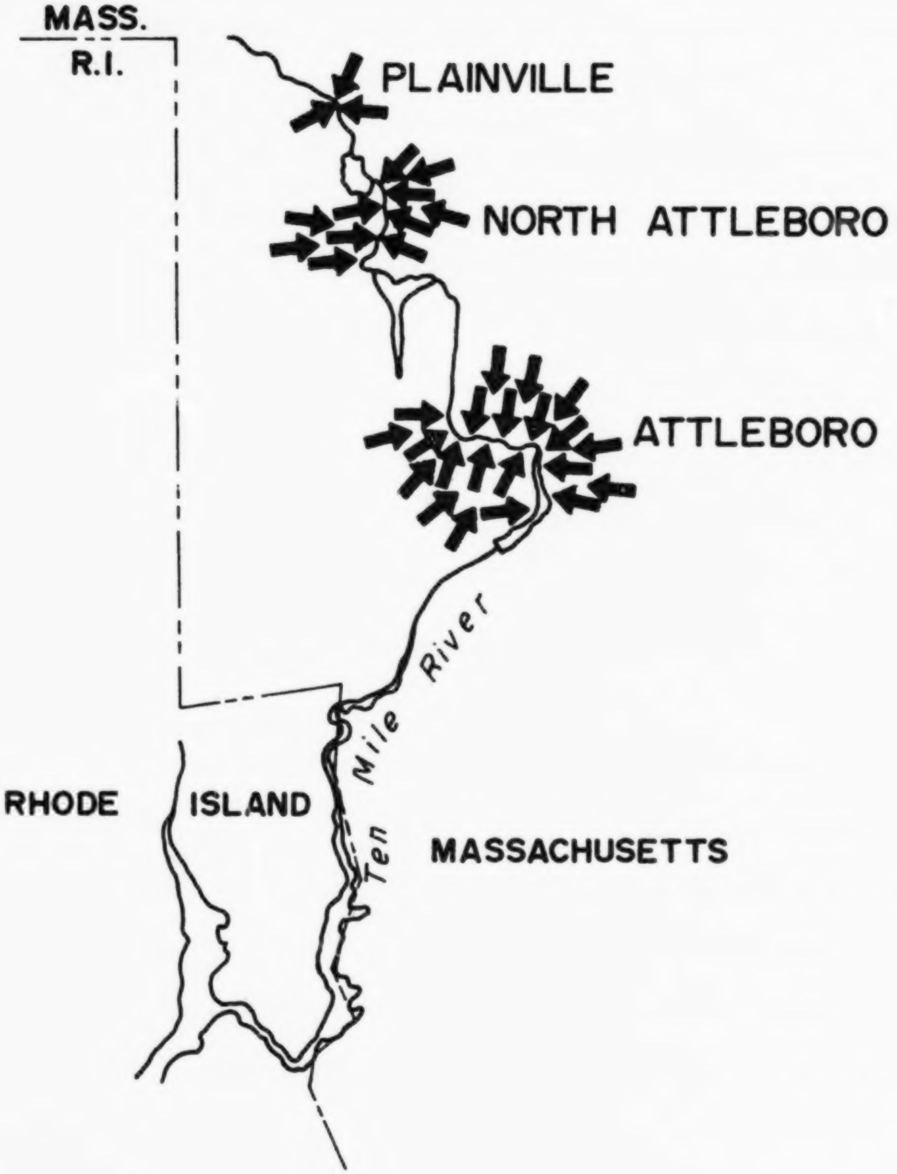
Numerous metal plating plants are situated in Plainville, North Attleboro, and Attleboro, Massachusetts. Although most of the plants are quite small, in combination they handle large volumes of a variety of highly toxic chemicals. Of these, cyanides of various metals used in plating probably are the most toxic. Metals used include gold, silver, rubidium, chromium, nickel, copper, and zinc. Most of these, even in low concentrations, are toxic to aquatic life. The sudden discharge of even a small tank of cyanide by accident, or by intent to dispose of a spent bath, could wipe out the fish population in the small flow of the Ten Mile River for many miles. A more subtle effect might be the accumulative destructive effect on aquatic life of minute quantities of these toxic materials from each of the many plants involved.

Table 6 (Appendix) lists the plating plants situated in the Massachusetts towns along Ten Mile River. Data that would permit an inventory of quantitative waste loads from each of the plants are not available at present.

Figure 6 shows the approximate locations of all known plants. There are 3 plants in Plainville, 11 in North Attleboro, and 21 in Attleboro.

COMBINED SEWERS

FIGURE 6
SOURCES OF PLATING WASTES
TEN MILE RIVER
AUGUST 1964 SURVEY


MASS.
R.I.
PLAINVILLE
NORTH ATTLEBORO
ATTLEBORO
Ten Mile River
RHODE ISLAND
MASSACHUSETTS

Worcester and Millbury in Massachusetts, with a total sewered population of 181,000, have combined or both separate and combined sewers. The status of storm water connections was undetermined in three smaller Rhode Island jurisdictions where domestic sewage is collected by old mill sewers. Combined sewers, which are common in older municipalities throughout the country, receive both domestic sewage and storm water.

Large quantities of sewage and storm water enter combined systems during storms. Overflow devices are provided to bypass portions of the mixed storm flows from the system to the nearest watercourse without treatment. Thus, the raw sewage diverted during storms intermittently may cause pollution of the receiving stream even after treatment has been provided for dry weather sewage flow.

EFFECTS OF POLLUTION ON WATER QUALITY AND USES

Excessive bacterial pollution of a stream presents a health hazard to those who come in contact with the water. Excessive suspended solids diminish the beauty of water and settle to and blanket the stream bottom where they form sludge deposits that can produce offensive odors, reduce or eliminate aquatic life on which fish feed, and interfere with fish spawning.

Excessive oxygen demand reduces the dissolved oxygen of the water, which results in reduction or destruction of desirable aquatic life, including fish, and may produce offensive odors.

Survey data, indicating the effects of pollution, are tabulated in the Appendix. Bacteriological data, including results of total and fecal coliform determinations, are shown in Tables 7 through 13. Biological data are reported in Tables 14 through 19. Chemical data, including 5-day BOD, D.O., temperature, pH, metals, ABS, nitrogen and sampling times are shown in Tables 20 through 39. River discharges are shown on Tables 40, 41 and 43.

BACTERIAL POLLUTION

Municipal sewage contains enormous numbers of bacteria, among which there are frequently pathogenic bacteria, derived from human excreta, that can cause gastrointestinal diseases such as typhoid fever, dysentery, and diarrhea. Infectious hepatitis, a virus disease, can also be caused by ingesting sewage-polluted water. Eye, ear, nose, throat, or skin infections may result from bodily contact with such waters. As the densities of pathogenic bacteria are reduced by sewage treatment or forces of natural purification, the hazards of contracting disease are proportionately reduced.

Sewage also contains bacteria of the coliform group which typically occur in excreta, or feces, and can readily be detected even at low densities. These bacteria, harmless in themselves, are determined in stream studies involving sewage pollution as indicators of the probable presence of pathogenic bacteria. In the absence of adequate methods for detection of other pathogenic organisms, such as viruses, in rivers, coliform bacteria also serve as indicators of the probable presence of these organisms.

For many years the laboratory method for determination of the coliform group has been a principal tool used by sanitary engineers in evaluating bacterial pollution of surface waters. The coliform group has been used by numerous State and interstate water pollution control agencies as a basis for water quality objectives for various water uses. Unfortunately, the coliform group includes several types of bacteria which may come from sources other than excreta, and coliform data sometimes have been challenged because of this. In the last few years a method for specific detection of fecal coliform bacteria only has been developed. Although the method has the decided advantage of specificity, it has not been in use long enough to serve as a basis for quantitative water quality objectives. Both methods of bacterial measurement were applied to all samples in this study.

The results of both determinations are expressed in terms of most probable numbers, or MPN, per 100 milliliters (ml) of water. One hundred ml is a little less than one-half cup. The coliform group usually is designated as total coliforms.

Neither Massachusetts nor Rhode Island has adopted a total coliform objective of water quality for recreational uses such as boating and fishing. Where such an objective has been adopted the commonly used MPN is 5,000 per 100 milliliters (ml) of water.

Both States have total coliform objectives for Class B waters, used for water contact sports such as swimming and skiing. The Massachusetts limit is a mean of 2,400 per 100 ml, and the Rhode Island MPN limit is a median less than 1,000 per 100 ml with not more than 20 percent of the samples equal to or greater than 2,400 per 100 ml during the bathing season.

The median coliform densities observed during the August 1964 survey are summarized in Table 13 and plotted on Figures 7 and 8. Horizontal lines through the 5,000, 2,400 and 1,000 MPN/100 ml values on the graphs permit comparison of the values found in the Blackstone and Ten Mile rivers with the total coliform water quality objective most commonly used for general aquatic recreation, and for water contact sports in Massachusetts and Rhode Island. River water densities at some locations can be compared with the 20,000,000 MPN/100 ml total coliform density level that can be expected in average raw domestic sewage.

Blackstone River

Raw and partially treated sewage, from both Massachusetts and Rhode Island, polluted the entire 40-mile reach of the Blackstone River included in the August 1964 survey. The total coliform objectives for water contact sports and general recreational use of the river were exceeded at every sampling station from Worcester, Massachusetts, to Central Falls, Rhode Island (Figure 7).

The horizontal line through the 5,000, 2,400, and 1,000 values on the graph permits comparison of the values found in the Blackstone River with the coliform water quality objective most commonly used for water recreation and for water sports in Massachusetts and Rhode Island.

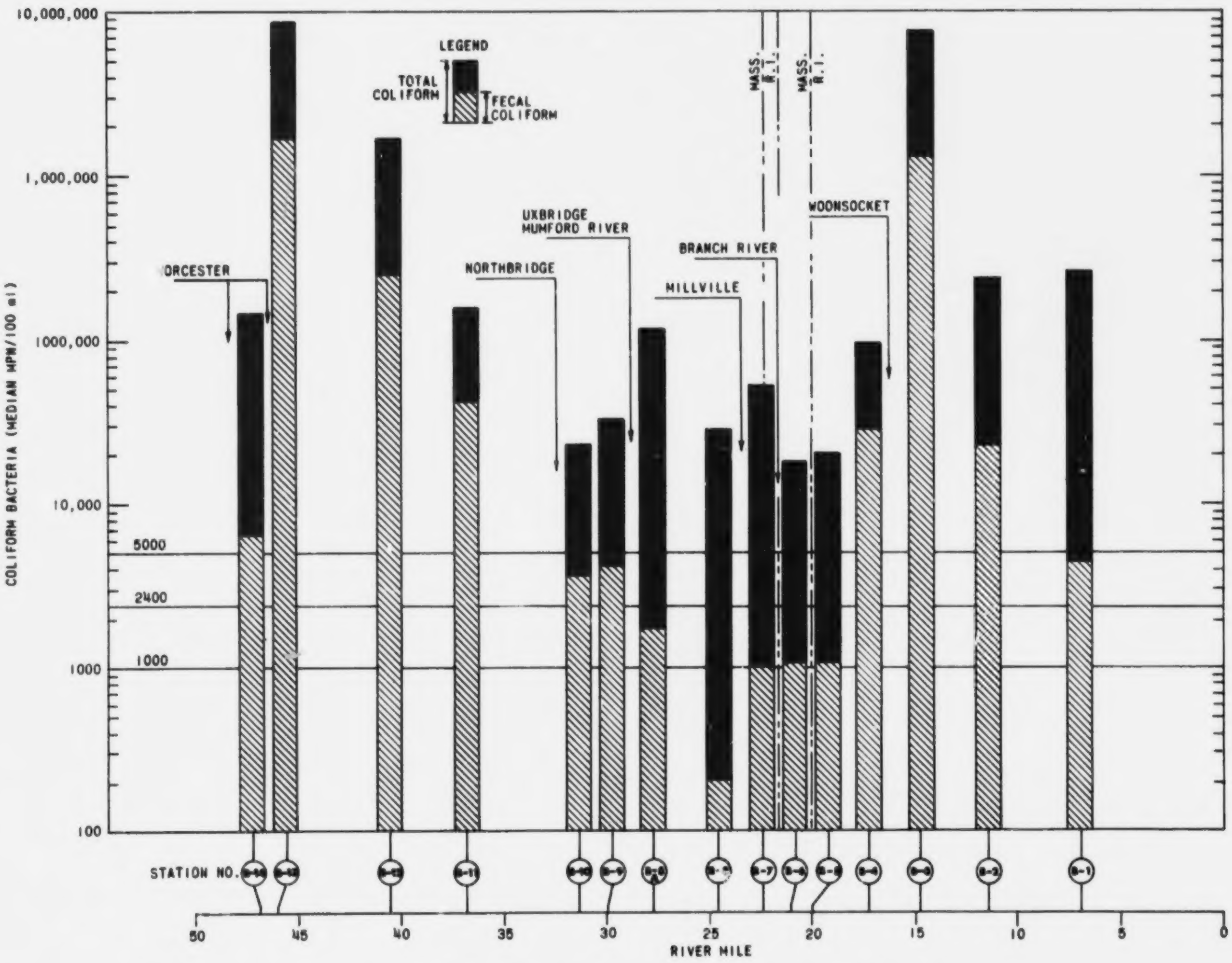


Figure No. 7. TOTAL & FECAL COLIFORM - BLACKSTONE RIVER - AUGUST 1964

The Blackstone River was most severely polluted in the vicinity of McCraken Road Bridge (B-13) about one-half mile below the outfall from the 22 million gallons per day Worcester sewage plant. At this location, sewage plant effluent amounted to almost one-half of the entire 48 million gallons per day (75 cfs) flow in the river, and the median total coliform density soared to 8.5 million per 100 ml of river water. Nineteen (19) percent, or 1,650,000, of this total were fecal coliform bacteria.

The observed median density, which was equivalent to about 5,000 coliform bacteria per drop of water, was 1,700 times higher than the objective for general recreational use. The enormity of this bacterial pollution can be visualized by realizing that the average total coliform density of raw sewage (20,000,000 MPN/100 ml) amounts to only slightly more than twice the median density in the river water.

After leaving Worcester, the river flowed through a series of impoundments in the 15-mile distance and 3-1/2 days flow time to the outlet of Rice City Pond. Within this reach, natural purification and bacterial die-off reduced the total coliform densities to 1,660,000 near Saundersville (B-12), 155,000 at Northbridge (B-11) and 22,500 at the outlet from Rice City Pond (B-10).

Within the next 9 miles, and approximately 2 days flow time, from Rice City Pond to the Massachusetts-Rhode Island State line, the bacterial pollution included in the untreated sewage discharges from Uxbridge, Millville, and local industries exceeded the bacterial reduction by natural purification in this reach, and the total coliform density increased to 51,500 MPN/100 ml at the State line (B-7 at R.M.-22.3). One thousand MPN/100 ml, or approximately 2 percent of this total, were fecal coliform bacteria.

The total coliform bacteria content of Blackstone River water crossing the Massachusetts-Rhode Island State line was 10 times the objective for general recreational use, and 20 times the Massachusetts objective, and 50 times the Rhode Island objective for water contact sports, including swimming and skiing.

Below the State lines, raw sewage from Woonsocket, Rhode Island, bypassed to the river during construction of the new treatment facilities, was primarily responsible for the sharp rise in coliform densities at the Manville Dam (B-3). At this point the median total coliform density increased to 7.5 million MPN/100 ml and the fecal coliform density increased to 1,300,000 or 17.5 percent of the total.

Total coliform densities in this grossly polluted reach of the river were 1,500 times the objective for general recreation, 7,500 times the Rhode Island objective for water contact sports, and more than one-third the density that can be expected in raw sewage.

Below Manville, the bacterial pollution had been reduced by natural purification, but at Central Falls (B-1) the 255,000 MPN/100 ml total coliform density was still 50 times the general recreational objective and 250 times the objective for water contact sports.

Bacteriological data collected during the August 1964 survey, and illustrated on Figure 7, show that unchlorinated raw and partially treated sewage discharged in Massachusetts polluted the interstate waters of the Blackstone River flowing across the State line from Massachusetts into Rhode Island. In addition to creating extremely severe local pollution, sewage discharges in Massachusetts, principally from Worcester, and in Rhode Island, principally from Woonsocket, endangered the health of all persons who might contact Blackstone River water anywhere throughout this entire 40-mile reach of the river.

Ten Mile River

The Ten Mile River was also severely polluted by sewage-associated bacteria. The coliform content of river waters observed during the August 1964 survey is reported in the Appendix Tables and illustrated on Figure 8.

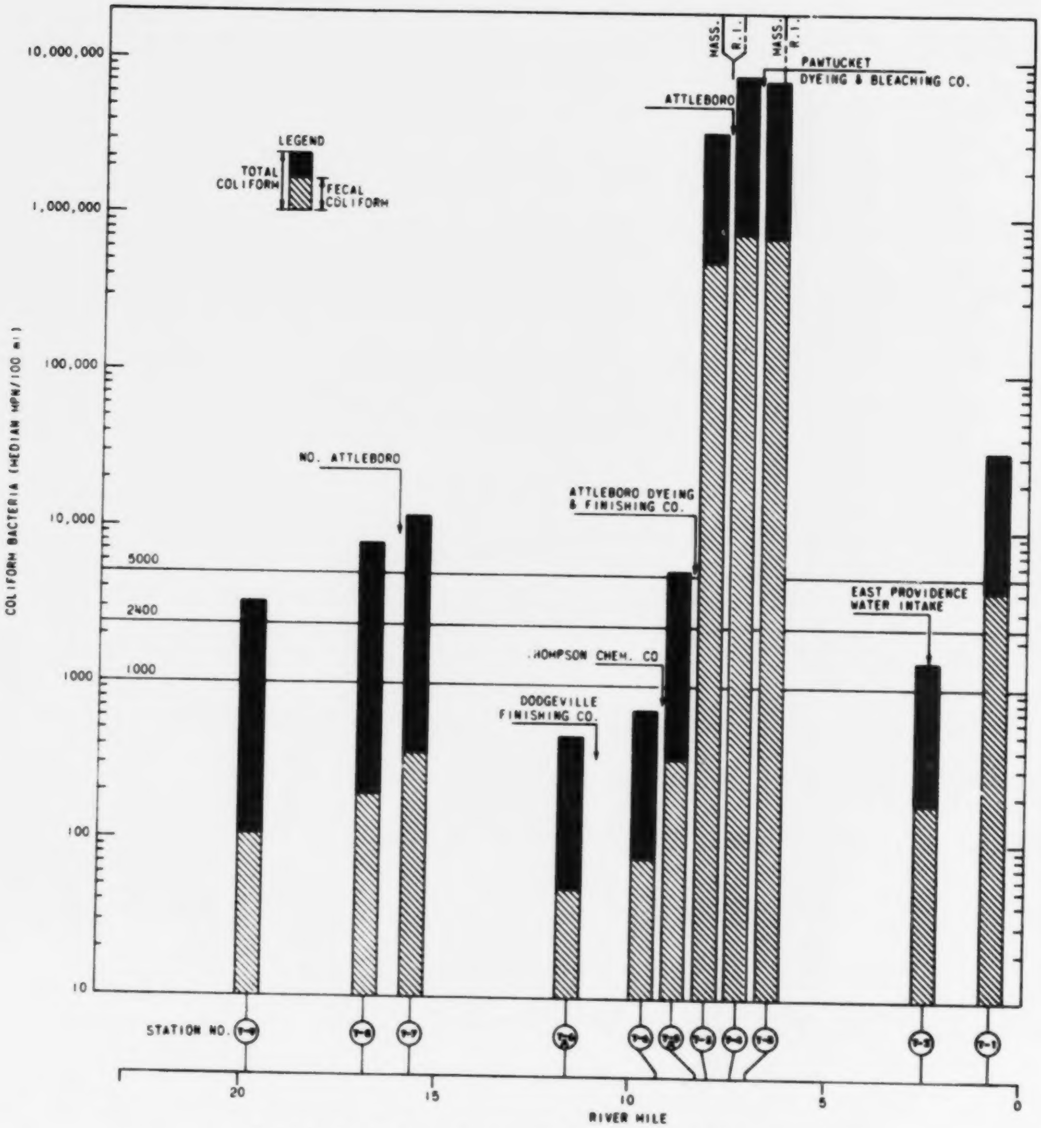


Figure No. 8. TOTAL & FECAL COLIFORM BACTERIA - TEN MILE RIVER - AUGUST, 1964

Bacteriological water quality objectives were exceeded in the vicinity of North Attleboro but the most serious pollution occurred below Attleboro near the State line.

Total coliform densities increased from 5,500 MPN/100 ml at the dam in the pool immediately upstream from the Attleboro Dyeing and Finishing Company to 3,400,000 at the next station located 0.1 mile downstream, but 0.2 mile above the Attleboro sewage treatment plant. The source of this increase, which amounted to about 3,000 bacterial population equivalents and was too large to be attributed to the upstream mill, was not found during the survey.

Unchlorinated effluent from the Attleboro sewage treatment plant, which entered the river about 0.1 of a mile upstream from the first Massachusetts-Rhode Island State line, was responsible for the largest coliform increase in Ten Mile River waters flowing from Massachusetts to Rhode Island. At Rhode Island Station T-4, located 0.3 miles below the first State line, the median total coliform density soared to 7.9 million MPN/100 ml which included 795,000 or 10 percent fecal coliform bacteria. Seven and one-half (7.5) million total coliform MPN/100 ml remained at Central Avenue, on the second Massachusetts-Rhode Island State line located 0.7 mile farther downstream.

After flowing another three and one-quarter miles through Central Pond and the East Providence Reservoir, the median total coliform density was reduced to 1,500 MPN/100 ml, with 185 MPN/100 ml or 12 percent fecal coliform, at the source of supply for the East Providence municipal water supply treatment plant.

Unidentified sources of additional bacterial pollution entered the river in the next mile and three-quarters to increase the median total coliform density to 33,000 MPN/100 ml at Roger Williams Avenue located about 0.8 mile above the mouth.

Sewage-associated bacteria, discharged into the river in Massachusetts, polluted the interstate waters of Ten Mile River flowing into Rhode Island. This pollution, which exceeded the 5,000 MPN/100 ml general recreational objective by 1,500 times at the State line, presented a serious hazard to persons, especially children who may come in contact with the water while playing and wading in the river.

K. M. Mackenthun

AQUATIC LIFE

Bottom organisms may be used to indicate the effect of pollution on aquatic life in a stream.

In an unpolluted stream, as shown in the next figure, twenty to thirty different kinds of bottom organisms may occur.

In the Blackstone River, however, these were not found, and the generally few different kinds of bottom organisms indicate the Blackstone's polluted condition.

Both upstream and downstream of Worcester, Massachusetts, only one kind was found. In the State line reach, five or six kinds were found, but this number dropped to two, as the full impact of the Branch River on the Blackstone River was indicated. Even the eleven different kinds in the downstream reach contained no clean water organisms.

Also, an unpolluted stream, in addition to containing many different kinds of organisms, harbors generally few individuals in any particular group, because of stream conditions and because of competition for food and space.

However, when an unlimited organic food supply is available, as in the Blackstone River, clean-water-associated forms are smothered out, and pollution-tolerant sludge worms obtain high population.

Downstream from the Worcester, Massachusetts, plant, as many as 55,000 per square foot were found. These populations gradually diminish as the food supply is reduced, but even at Manville, just upstream from the State line, over 3,000 sludge worms per square foot were observed.

A reduction was noted downstream of the Branch River, which was downstream of the State line, thus illustrating a toxic effect of this stream on the aquatic life of the Blackstone River.

Downstream of Woonsocket, again the sludge worm population exceeded 23,000 per square foot.

Environments in which aquatic organisms live can be modified by man-produced pollution, or by natural pollutants that may be catastrophically introduced into the aquatic environment. Unpolluted water courses support many kinds of clean-water-associated bottom organisms such as mayflies, stoneflies, alderflies, certain beetles, and caddisflies. Some intermediate forms such as snails, craneflies, sowbugs, and certain midges also may be present, and pollution-tolerant organisms consisting of sludgeworms, certain leeches, and midges with special respiratory organs usually are few in number. Stream conditions that permit the development of an assemblage of clean-water-associated forms provide food for fishes and prevent development of nuisance organisms in large numbers.

Responses of aquatic organisms to domestic and industrial wastes depend largely on amounts and kinds of such materials entering their environments. One response is manifest by the loss of a few kinds of organisms that thrive only in clean water environments, while those associated with mildly polluted waters increase slightly in numbers. A more drastic response involves the disappearance of all clean-water-associated forms and the development of pollution-tolerant organisms often associated with sludges and slimes.

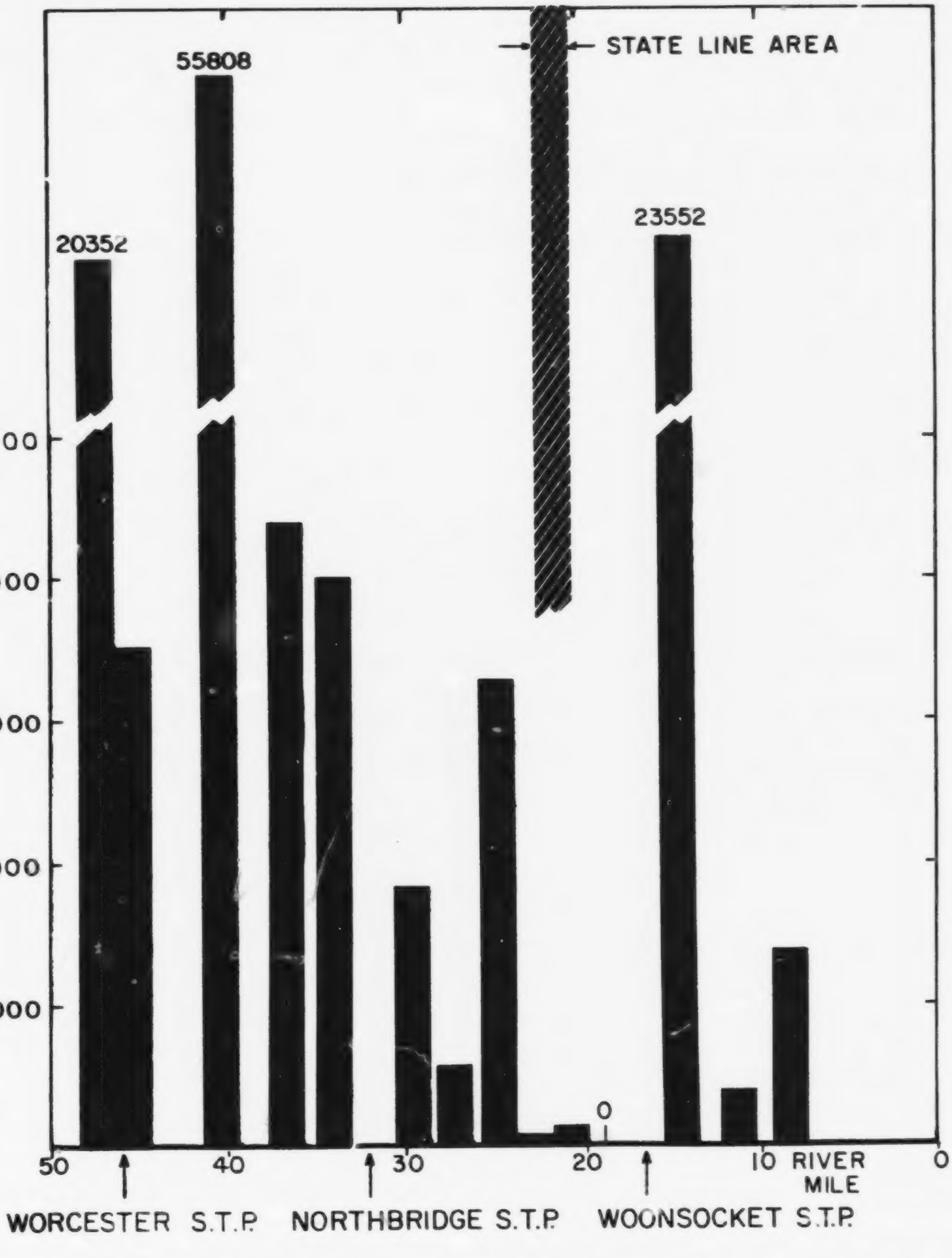
Biological surveys of the Blackstone and Ten Mile Rivers were conducted in March and August 1964 at stations shown in Table 1.

Blackstone River

Bottom samples collected in March from Tatnuck Brook, a headwater tributary of the Blackstone River above Worcester, Massachusetts, contained 20 different kinds of organisms including clean-water-associated stoneflies, mayflies, riffle beetles, and caddisflies (Table 14). As in Tatnuck Brook, many different kinds of bottom organisms are to be found in stream reaches not affected by pollution. The number of individuals representing each kind are small because of predation among species and competition for food and space.

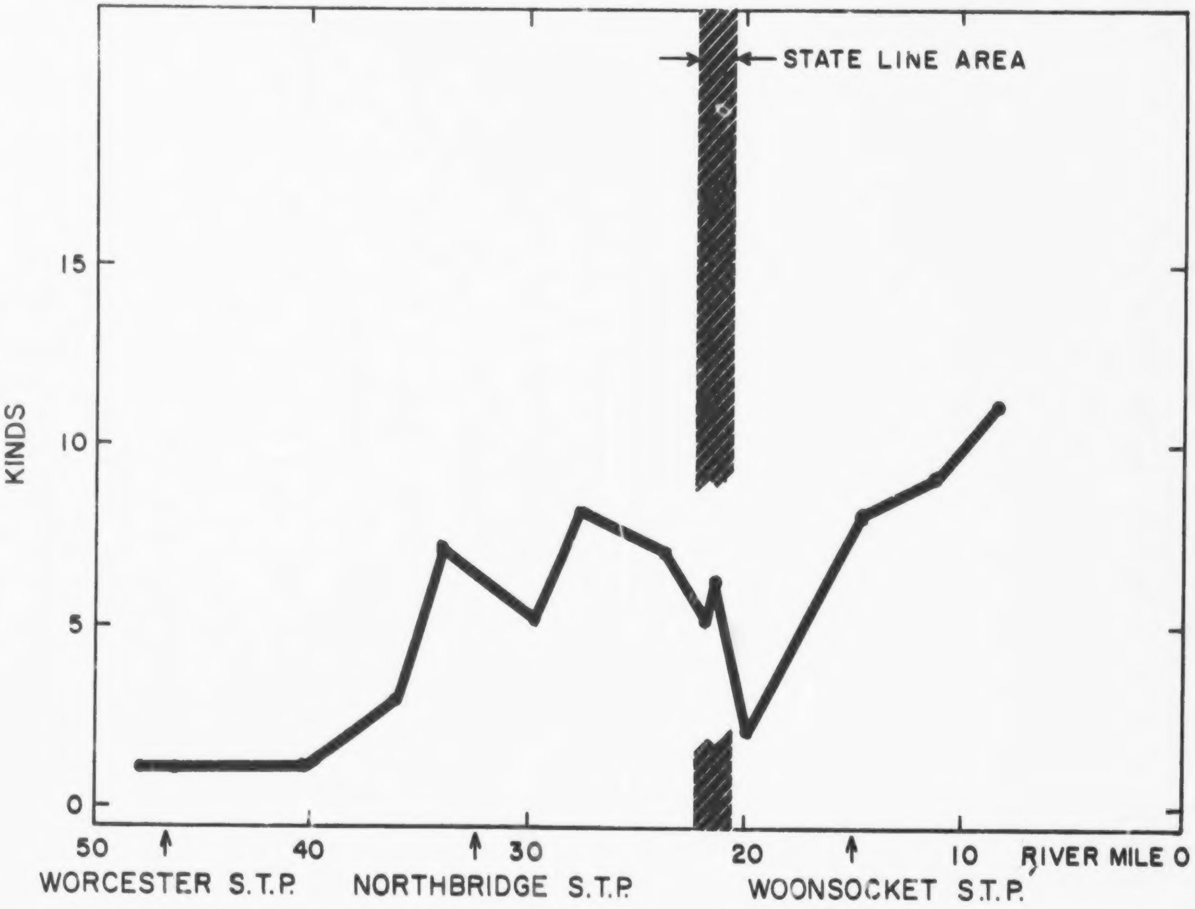
Sludge deposits, oily substances, and slime growths found in the Blackstone River at the southeastern edge of Worcester, Massachusetts (mile 47.9), supported dense populations of sludge-worms (Figure 9, Tables 14 and 15). Such pollution-tolerant populations (20,352 sludgeworms per square foot) are dependent on an abundant supply of organic wastes, and reflect the severely polluted character of the stream in this reach. Although the natural stream bottom throughout the entire Blackstone River could, if not polluted, support many different kinds of aquatic life, only pollution-tolerant sludgeworms were present in samples collected between Worcester and the eastern edge of Wilkinsonville, Massachusetts. In March, such conditions persisted farther downstream to the Northbridge area. Summer temperatures and an abundant supply of nutrients in the Northbridge area produced dense growths of aquatic plants that held sludge deposits and supported slime growths. Floating masses of detergent foam also detracted from the river's aesthetic value.

In the downstream reach from Northbridge to Millville, Massachusetts (mile 25.0), the number of kinds of organisms remained low during March, but increased to 8 in August (Figure 10). Organisms associated with clean water were not found. Sludgeworms and other pollution-tolerant forms comprised



NUMBERS OF POLLUTION-TOLERANT BOTTOM ORGANISMS, PER SQUARE FOOT, BLACKSTONE RIVER, AUGUST, 1964

FIGURE 9



KINDS OF BOTTOM ORGANISMS, BLACKSTONE RIVER,
AUGUST, 1964

FIGURE 10

most of the total bottom organism population, and in August the region contained abundant aquatic vegetation indicating a rich supply of nutrients. The presence of sludge deposits, oily substances, and slimes attested to the polluted condition.

Just below Millville, Massachusetts (mile 23.7), in excess of 3,000 pollution-tolerant sludgeworms were found in a square foot of bottom. Sludge deposits were evident along the sides of the stream for as much as 20 feet out from shore. No clean-water-associated fish food organisms were found.

The Blackstone River is impounded just upstream from the point where it first crosses the Massachusetts-Rhode Island State line. Abundant nutrients provide conditions favorable to the development of dense growths of aquatic vegetation, slimes, and attached algae downstream from the impoundment on both sides of the State line during the summer months. These growths precluded quantitative sampling to determine the density of individuals comprising the various kinds of bottom organisms. Qualitative sampling, however, showed six kinds of bottom organisms living in this weedy reach: one form of caddisfly represented the sole clean-water-associated bottom organism; three kinds were intermediate forms (blackflies, snails, and midges without blood gills); and the remaining two kinds were pollution-tolerant organisms comprised of leeches and sludgeworms.

If vegetative growths and algal slimes were not so abundant, other clean-water-associated organisms, such as stoneflies, riffle beetles, mayflies, hellgrammites, etc., could abound in the area. If fish were present in this short reach it would be doubtful that they could utilize the existing food supply because the organisms were in the root mass of the attached vegetation, and it would be doubtful that game fish could forage in such a densely vegetated area. Also, because of dense vegetation it is unlikely that fish could utilize this area for spawning. Attached algae, slimes, and aquatic vegetation do not present an aesthetically pleasing sight. This stream reach was polluted.

Below the Massachusetts-Rhode Island State line just above the confluence with the Branch River in Rhode Island, the density of aquatic vegetation in the Blackstone River was much reduced and sludge deposits were not observed. The population of bottom organisms remained low and no clean-water-associated organisms were found. Below the Branch River, wastes carried by the Branch River contributed to the pollution of the Blackstone River. Aquatic plants were very abundant, and these were covered with slimes consisting of bacteria and filamentous algae. Variously colored wool fibers similar to those found in the Branch River also were observed upon microscopic examination of samples collected in this area. Extensive sludge deposits and oily substances covered much of the gravel on the stream bottom. Turbidity of the river in this section was sufficient to give the water a dark-gray appearance. Such conditions show pollution of the Blackstone River.

At the Singleton Street Bridge, Woonsocket (1.9 miles below the confluence with the Branch River), total kinds of organisms were reduced to 2 from 6 at the station immediately upstream. The total numbers of bottom organisms per square foot were reduced to 13 from 464 immediately upstream. Toxicity from the Branch River was evident.

Below Woonsocket, Rhode Island, extensive sludge deposits, a dense sludgeworm population of 23,040 organisms per square foot near river mile 14.6 (Figure 9), and the lack of organisms associated with clean water attested to pollution of the Blackstone River in this reach. Oily substances, detergent foams, slimes, floating solids, and refuse compounded the pollution problem. Although the lowermost reaches of the Blackstone River supported up to eleven kinds of bottom organisms in August, no clean-water-associated forms were found. The lack of clean-water-associated organisms and the predominance of pollution-tolerant forms show the extent of pollution throughout the remainder of the Blackstone River.

Samples of bottom organisms collected in March from Branch River downstream from Branch River Wool Combing Company contained only a few sludgeworms (Table 16). Samples obtained from the same area in August had just two kinds of pollution-associated organisms and these were represented by few individuals (Table 17). At Branch River mile 1.1, upstream from Branch River Wool Combing Company but downstream from Stamina Mills (mile 1.7), five kinds of organisms were represented again by few individuals; none were clean-water-associated forms. The stream bottom in this entire reach contained many wool fibers. Extensive sludge deposits, floating balls of wool fibers impregnated with grease, and slimes on bottom materials also were noted. The intensely polluted condition of this reach of Branch River and toxicity of the water to bottom organisms compounded pollution of the Blackstone River below their confluence.

During August the Branch River at Slatersville, Rhode Island (mile 2.6), supported 17 kinds of organisms including six clean-water-associated forms such as mayflies, caddisflies, and riffle beetles. These bottom organisms represent good water quality. The Chepachet and Pascoag Rivers form the Branch River near Mapleville, Rhode Island. Upstream from this junction, the Chepachet River supports 13 kinds of organisms including clean-water-associated mayflies, caddisflies, and beetles; pollution-tolerant forms were not found in this area. Such an assemblage of organisms comprises an abundant supply of food for the fish in the area.

The Mumford River is polluted where it joins the Blackstone River at Uxbridge, Massachusetts. Although eleven kinds of organisms were observed, only one clean-water-associated form was found, and these occurred in low numbers (Table 17). Similar stream conditions were noted at river mile 1.2 between Uxbridge and North Uxbridge, Massachusetts. A short distance upstream at Whitinsville, Massachusetts, rocks on the stream bottom were sufficiently cemented together with a reddish precipitate to preclude quantitative sampling. Qualitative sampling, however, disclosed no organisms in March and only a few kinds in August. The lack of clean-water-associated forms indicates pollution in this area of the Mumford River.

Effluents entering the Mumford River just below the Hayward-Schuster Woolen Mills, Inc., Company produced intense pollution downstream near river mile 7.4. In March no animal organisms were found, while in August such forms were represented by only a few midges and sludgeworms. Large mats of wool fibers impregnated with grease, algae, and slimes were observed on bottom materials and vegetation projecting into the stream. Six kinds of bottom organisms were found just above this effluent, and wool fibers, grease, and slimes were not observed. At mile 11.6 and 10.2, above the Hayward-Schuster Woolen Mills, Inc., Company and the Einiger Corporation, 7 kinds of clean-water-associated organisms indicated suitable water for aquatic life.

Prior to its confluence with the Blackstone River and below Waucantuck Woolen Mills, Inc., Company, the West River supported 6 kinds of organisms; none of these represented the clean-water-associated group. Aquatic life in the West River shows the effects of moderate pollution.

In general, a study of bottom organisms of the Blackstone River showed stream degradation from wastes originating in Worcester, Massachusetts, and with additional waste contributions in downstream reaches, the polluted bottom conditions extended through Woonsocket, Rhode Island. The Blackstone River receives polluted water from the Mumford River in Massachusetts, and in the region of the State line, from the Branch River in Rhode Island. Pollution from Woonsocket further degraded the stream below this point.

Ten Mile River

Ten Mile River is severely degraded from below Whiting Road in North Attleboro, Massachusetts, to the point where it joins the Seekonk River in East Providence, Rhode Island. In this 19-mile reach, Ten Mile River supports a minimal population of clean-water-associated organisms only in its upper reach above North Attleboro (Figures 11 and 12; Tables 18 and 19).

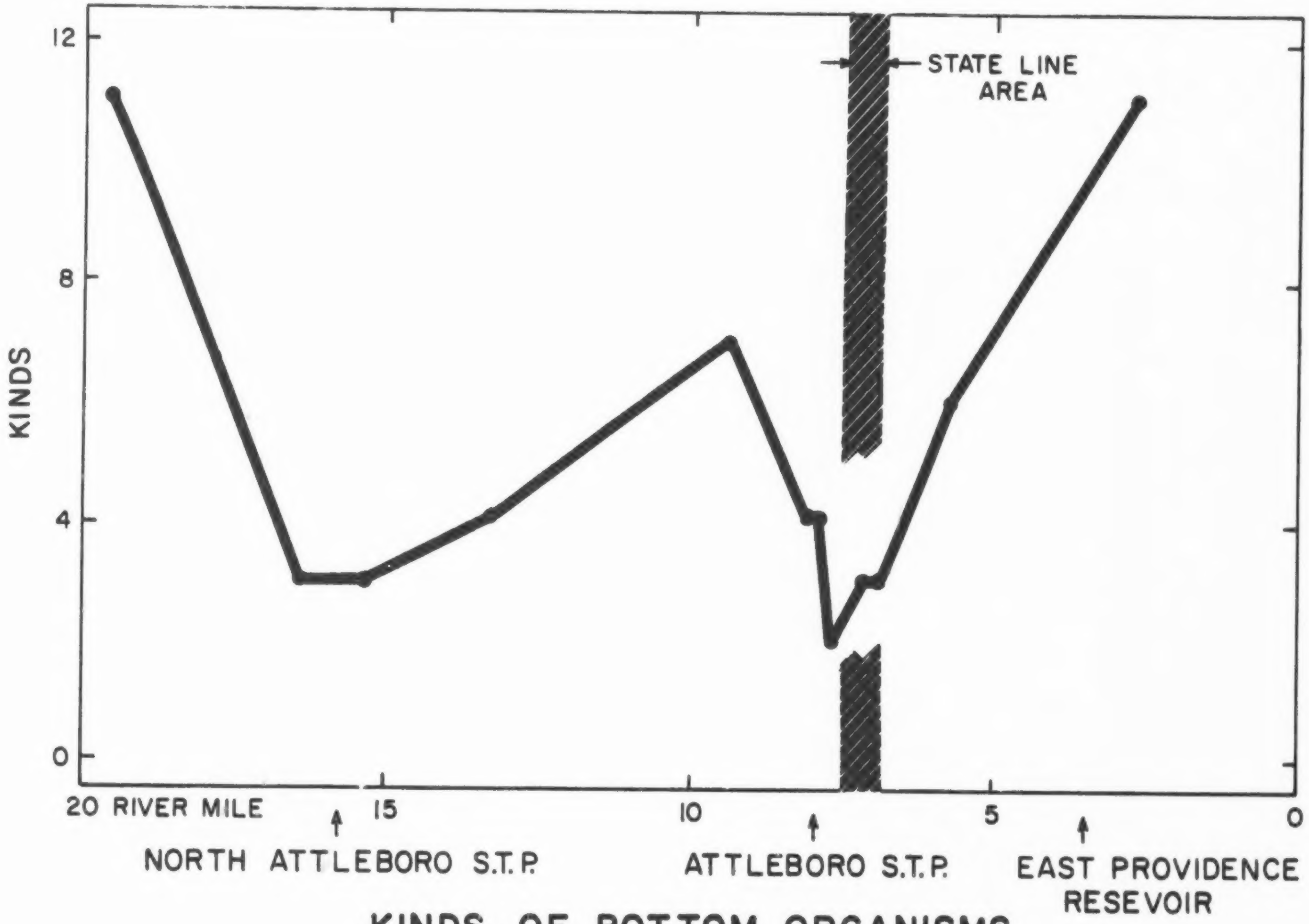
Just downstream of Whiting Pond, 11 different kinds of organisms were observed, several of which were clean-water-associated groups.

As one advances downstream, the number of kinds was reduced, and only two or three were found in the State line reach.

Eleven different kinds were found in the lowermost reach surveyed and contained no clean-water-associated forms. In some areas downstream of this, the low population was attributed to toxic constituents within the environment.

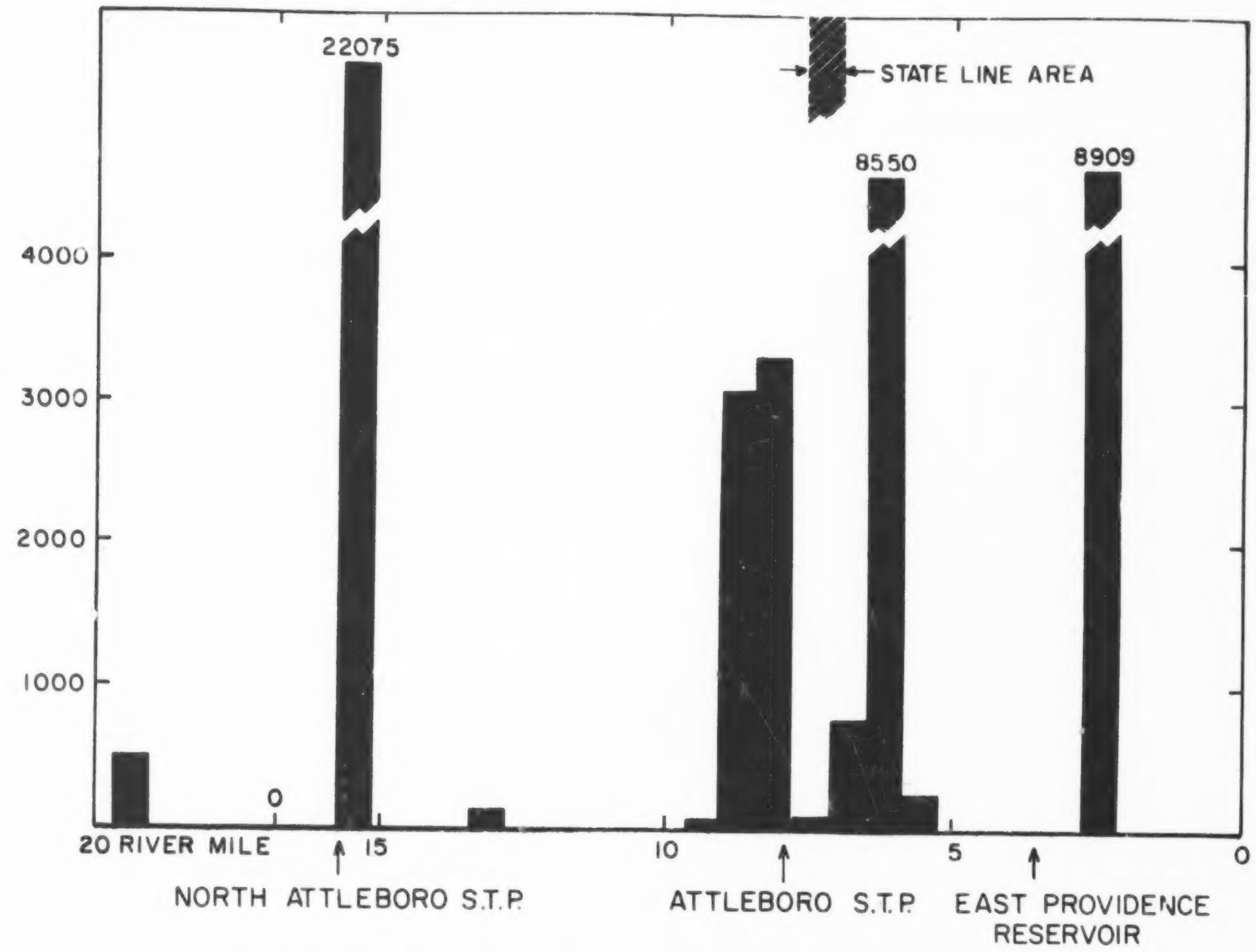
A paucity of bottom organisms occurred near the southern edge of North Attleboro. Some improvement, however, was noted downstream a short distance below.Coral Lake above the North Attleboro sewage treatment plant. Bottom organisms in this area consisted of a hellgrammite and two midges (Table 19). Algal slimes also were present. This reach has the potential to support additional kinds of bottom life, but such potential is inhibited by moderate pollution.

Extensive sludge deposits, slimes, microscopic



KINDS OF BOTTOM ORGANISMS, TEN MILE RIVER, AUGUST, 1964

FIGURE 11



NUMBERS OF POLLUTION-TOLERANT ORGANISMS,
PER SQUARE FOOT, TEN MILE RIVER, AUGUST, 1964

FIGURE 12

stalked forms, and pollution-tolerant populations of sludgeworms and midges approaching 22,000 organisms per square foot of stream bottom were found in the reach between the North Attleboro sewage treatment plant and Farmers Pond near Attleboro, Massachusetts (Figure 12). Pollution-tolerant sludgeworms and midges were less abundant downstream in Attleboro. Few different kinds of organisms and the presence of extensive sludge deposits impregnated with grease indicate severe pollution and probable toxicity in this latter reach of Ten Mile River.

During August, wastes in Ten Mile River at Attleboro contributed sufficient nutrients to support dense populations of a suspended microscopic organism (Euglena sp.) in the pond at Hebronville. Such populations, about 19 million organisms per quart of pond water (20,000 per ml), accounted for high turbidities and imparted a green unsightly color to the water. Seven kinds of bottom organisms were found in Ten Mile River just below the pond at Hebronville in August, but none of these were associated with clean water.

Only 4 kinds of bottom organisms were present in Ten Mile River above an unnamed tributary and the Attleboro sewage treatment plant. Pollution-tolerant midges and sludgeworms were well represented, and stream bottom materials were covered with oily sludge and slimes. Below this tributary the number of individuals representing the four kinds of bottom organisms were much reduced. Although four kinds of organisms were still present in this reach, the decrease in numbers of individuals suggests that wastes entering Ten Mile River from the unnamed tributary were toxic. No organisms were found in this tributary below the Attleboro Dyeing and Finishing Company in the oily sludge-covered bottom of this purple-black unnamed tributary located just upstream from the State line on Ten Mile River. This severely polluted tributary contributes to interstate pollution at the State line.

At the first Massachusetts-Rhode Island State line crossing, pollution became more severe. Effluents from the Attleboro sewage treatment plant contributed to extensive deposition of sludge and, because of unsuitable water quality, a reduction in both numbers and kinds of bottom organisms occurred (Figures 11 and 12). Even sludgeworms found living difficult in this area. Slimes, algae and sludges covered much of the gravel and sandy stream bottom. At the second State line, Ten Mile River supported dense growths of aquatic weeds covered by stalked microscopic forms that indicated a bountiful bacterial food supply, and slimes. Bottom organisms in this polluted area consisted principally of pollution-tolerant midges and sludgeworms. Sludge again was evident.

A similar assemblage of organisms occurred at the third State line below the waste outfall from the Pawtucket Dyeing and Bleaching, Inc., plant. The effluent from the plant holding ponds was deep purple in color. The stream bottom at this point was covered with sludge, and rattail maggots -- those organisms that are adapted to live in a stream devoid of oxygen -- were observed where the effluent enters Ten Mile River.

Improved water quality was indicated downstream above East Providence Reservoir (mile 5.8) since this reach of the Ten Mile River supported 6 kinds of bottom organisms in August and 4 kinds in March. However, clean-water-associated forms were lacking and pollution-tolerant forms such as sludgeworms, leeches, and midges with blood gills were present. Algal slimes, and dense growths of aquatic plants, also were noted. The condition of the water is such that in all probability a game fish population could not be supported.

Although 11 kinds of bottom organisms were present just below the East Providence Reservoir, the lack of clean-water-associated forms also shows the effect of pollution in this reach of Ten Mile River.

In general, Ten Mile River was severely degraded by pollution from below Whiting Pond in North Attleboro, Massachusetts, to the point where it joins the Seekonk River in East Providence, Rhode Island. At the Massachusetts-Rhode Island State lines, sludge deposits and slime growths were evident, and aquatic animal life was limited to those tolerant organisms that could withstand a polluted environment.

OXYGEN DEMAND AND DISSOLVED OXYGEN

Sewage and many industrial wastes contain organic matter that decomposes and exerts an oxygen demand in the receiving stream. In the process of decomposition, oxygen derived from the atmosphere and dissolved in the water is used, and the normal content of dissolved oxygen (DO) is reduced. If the DO is reduced below an adequate level, the fish population and the aquatic life on which the fish feed are killed or driven out of the area. Most water pollution control agencies have adopted a minimum 5 mg/1 DO objective to maintain the maximum potential warm water sport fish population.

Both Massachusetts and Rhode Island have adopted 5 mg/1 as one of the minimum standards of quality for Class C waters. One of the definitions of Class C water is, "...suitable...habitat for wildlife and common food and game fishes indigenous to the region..."

Blackstone River

5-Day Biochemical Oxygen Demand

The Blackstone River was grossly polluted by oxygen-demanding sewage and industrial wastes in both Massachusetts and Rhode Island (Figure 13). The moderately high 6.5 mg/1 BOD at the uppermost sampling station, which indicated that non-intercepted oxygen-demanding wastes had entered the river in Worcester, increased sharply to 26.8 mg/1 one-half mile below the Worcester sewage treatment plant outfall. This high demand, plus those from other downstream sources of wastes, severely polluted local reaches of the river, but were largely satisfied by natural purification forces by the time the river reached the first Massachusetts-Rhode Island State line, where the BOD had been reduced to 3.4 mg/1. These wastes had, however, taken their toll of river water dissolved oxygen in Massachusetts.

The Branch River in Rhode Island, which was polluted by wastes from the Stamina Mills and primarily from the Branch River Wool Combing Company, contained 88.4 mg/1 BOD, which is phenomenally high for river waters, about a mile above its confluence with the Blackstone River. This waste polluted the Blackstone River in both Rhode Island and in the

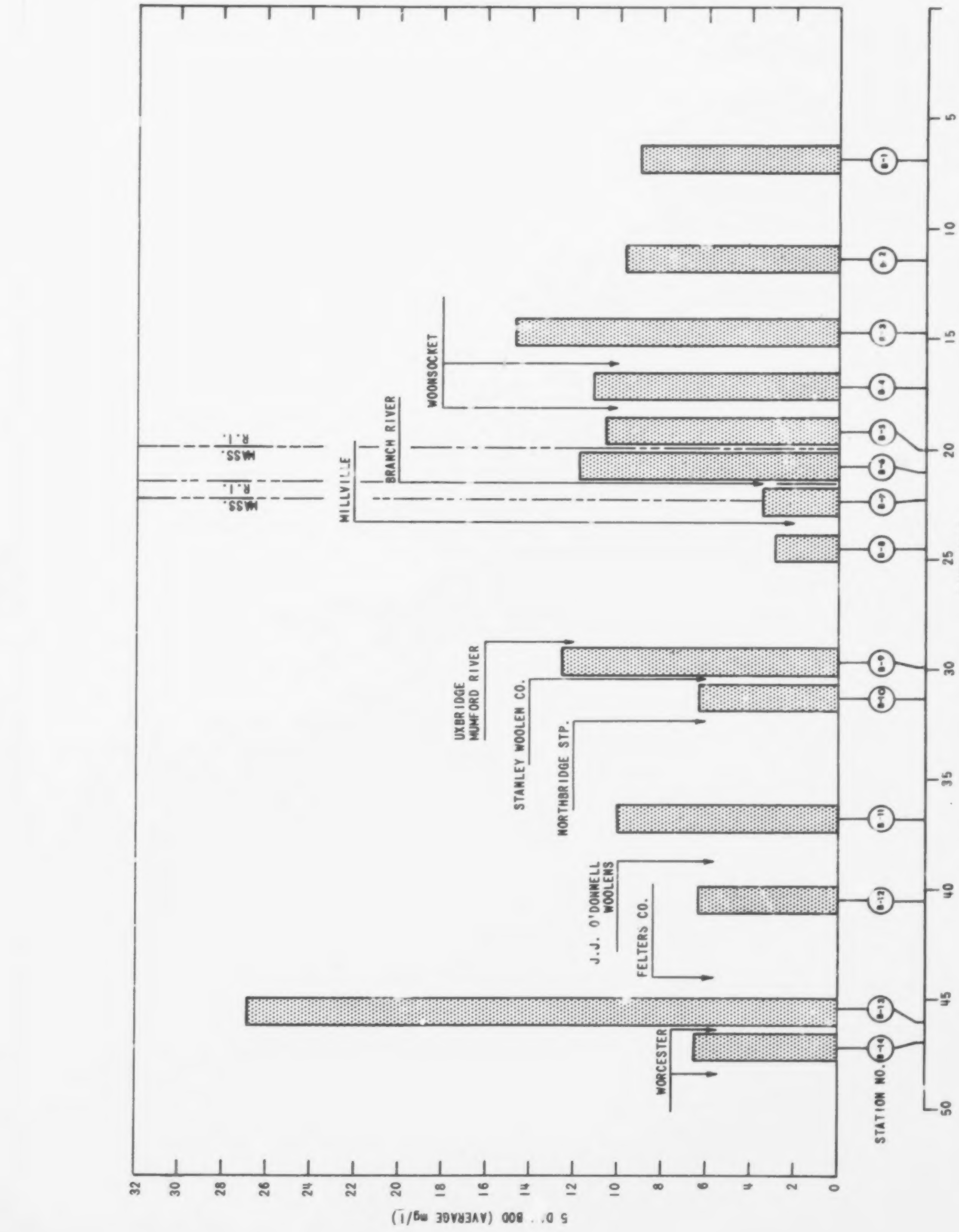


Figure No. 13. 5-DAY BIOCHEMICAL OXYGEN DEMAND (BOD) - BLACKSTONE RIVER - AUGUST 1964

Massachusetts reach near Blackstone, Massachusetts, where the river had again crossed the State line.

Sewage and industrial wastes from Woonsocket, Rhode Island, further increased the pollutional load carried by the Blackstone River, and the BOD was further increased to 14.7 at Manville, Rhode Island.

Downstream of Manville, these wastes again reduced the dissolved oxygen, while the BOD was reduced to the still high level of 9.5 mg/l at the Broad Street bridge in Central Falls, Rhode Island.

Dissolved Oxygen

While the 5-day biochemical oxygen demand figures show the degree of organic pollution, the dissolved oxygen concentration in the river, as shown on Figure 14, illustrates the adverse effects of this pollution on the aquatic life environment. Since fish and other aquatic life are adversely affected by minimum DO values, these values are more significant than the average conditions that prevailed throughout the survey.

The dissolved oxygen concentration of samples collected during the routine survey, shown on Figure 14, illustrates the drastic reduction in DO caused by the waste

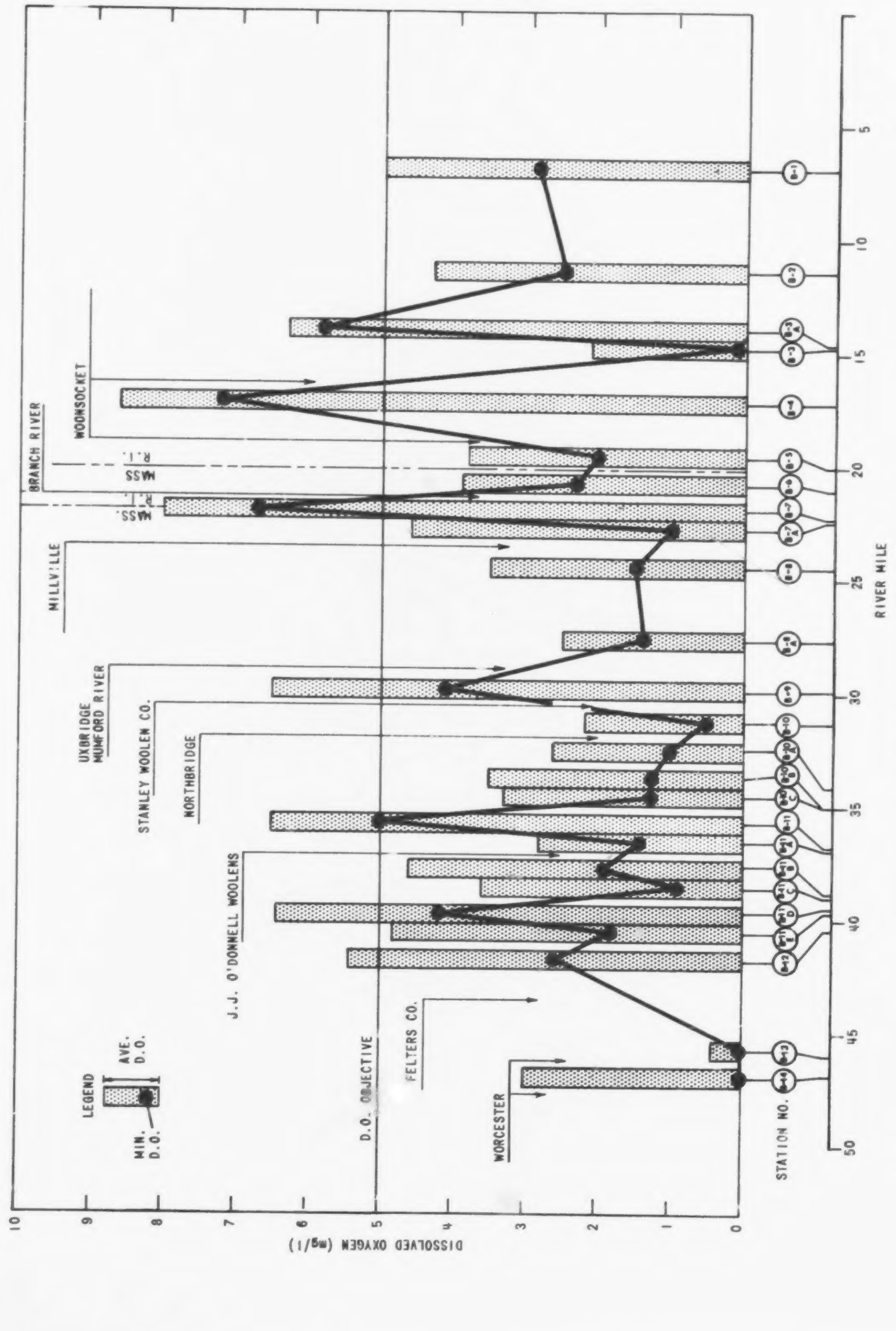


Figure No. 14. DISSOLVED OXYGEN - BLACKSTONE RIVER - AUGUST 1964 discharges, partial DO recovery following natural reaeration in normal stream channels and riffle areas, further loss of DO in impoundments, and the immediate, though temporary, beneficial effect of reaeration where the river splashed over dams and rushed through intervening rapids.

Sewage and industrial wastes entering the river from Worcester reduced the average DO far below the 5 mg/1 objective, and at times removed all dissolved oxygen from the river, both above and below the Worcester sewage treatment plant outfall. Natural reaeration, especially throughout the rapids in the vicinity of Millbury, added dissolved oxygen to the stream by the time it reached the Pleasant Street bridge in Saundersville (B-12), but upon flowing through the next impoundment, the DO was again lowered to an average of 4.8 and a minimum of 1.8 mg/1 at the crest of the Fisherville dam.

Almost 2.5 mg/1 of atmospheric oxygen were absorbed by the river splashing over the Fisherville dam, but the continued decomposition of the residual waste loads in the sluggish waters of the next downstream impoundment again reduced the minimum DO to less than 1 mg/1 at the crest of the Farnumsville dam. This general pattern of partial recovery following reaeration, and then subsequent loss of river DO to the oxygen-demanding pollutional loads repeated itself as the river flowed down through Massachusetts.

In the pool immediately above the Lonsdale dam, 500 feet upstream from the first Massachusetts-Rhode Island State line, the minimum DO value showed that at times the river contained only 1.0 mg/1 of dissolved oxygen.

Fortunately for the downstream reach of river in Rhode Island, the river was again reaerated as it splashed over the dam and rushed down the 500 feet of rapids to the State line, where the dissolved oxygen content was increased to a minimum of 6.7 mg/1, and an average of 10.2 mg/1.

Wastes from the Stamina Mills and the Branch River Wool Combing Company, discharged into the Branch River in Rhode Island, in combination with the BOD residual from Massachusetts, polluted the interstate waters of the Blackstone River and reduced its dissolved oxygen below the objective for fish and aquatic life as it crossed the second State line into the Massachusetts loop at Blackstone, Massachusetts. At Bridge Street in Blackstone, Massachusetts, the DO averaged 3.9, the minimum value fell to 2.3, and 70 percent of all samples collected contained less than the 5 mg/1 dissolved oxygen objective.

After crossing the State line for the third time, and reentering Rhode Island, the DO content of the waters was repeatedly depressed by the decomposition of wastes and increased by reaeration over a series of dams; but the overpowering effect of Woonsocket sewage and industrial wastes reduced the average DO to 2.1, and the minimum dissolved oxygen to 0.1, or almost zero, in the pool immediately above the Manville, Rhode Island, dam.

At the Broad Street bridge in Central Falls, Rhode Island, the average DO increased to 5 mg/1, but the minimum was only 2.9 mg/1.

Industrial wastes and partially treated sewage, entering the Blackstone River in Massachusetts, degraded local reaches of the river to levels that were intolerable to desirable fish and aquatic life, but reaeration at the Lonsdale dam increased the DO of the river water above the 5 mg/1 objective as it flowed into Rhode Island.

Wastes from Stamina Mills and the Branch River Wool Combing Company polluted the Branch River, which in turn polluted the interstate reach of the Blackstone River flowing from Rhode Island into the Massachusetts loop of the river.

Ten Mile River

5-Day Biochemical Oxygen Demand

The average 5-day BOD's of river water samples collected from the Ten Mile River during the August 1964 survey are shown on Figure 15. The BOD increased from 4.3 mg/1 above the North Attleboro sewage treatment plant to 9.1 below the sewage plant, to 12.4 below the Dodgeville Finishing Company, with a further sharp increase to 25.8 below Thompson Chemical Company. Successive waste discharges greatly exceeded the recovery capacity of the stream, and additional wastes from the Attleboro Dyeing and Finishing Company and the other undetermined source of sewage in Massachusetts finally increased the BOD to a peak of 31.9 mg/1 at sampling station No. T-5, located 0.3 of a mile above the first Massachusetts-Rhode Island State line. Although the BOD of the river water was lower below the Attleboro sewage treatment plant and the Pawtucket Dyeing and Bleaching Company, it remained at the relatively high value of 22 mg/1 where the river flowed back and forth across the State lines and finally into Rhode Island.

At the crest of the East Providence water supply reservoir dam, some 4-½ miles downstream in Rhode Island, the average BOD was reduced to 7.1 mg/1. Additional wastes from unidentified sources enter the stream below the reservoir, and at the Roger Williams Avenue bridge, located 0.8 mile above the mouth, the BOD had increased slightly to 7.7 mg/1.

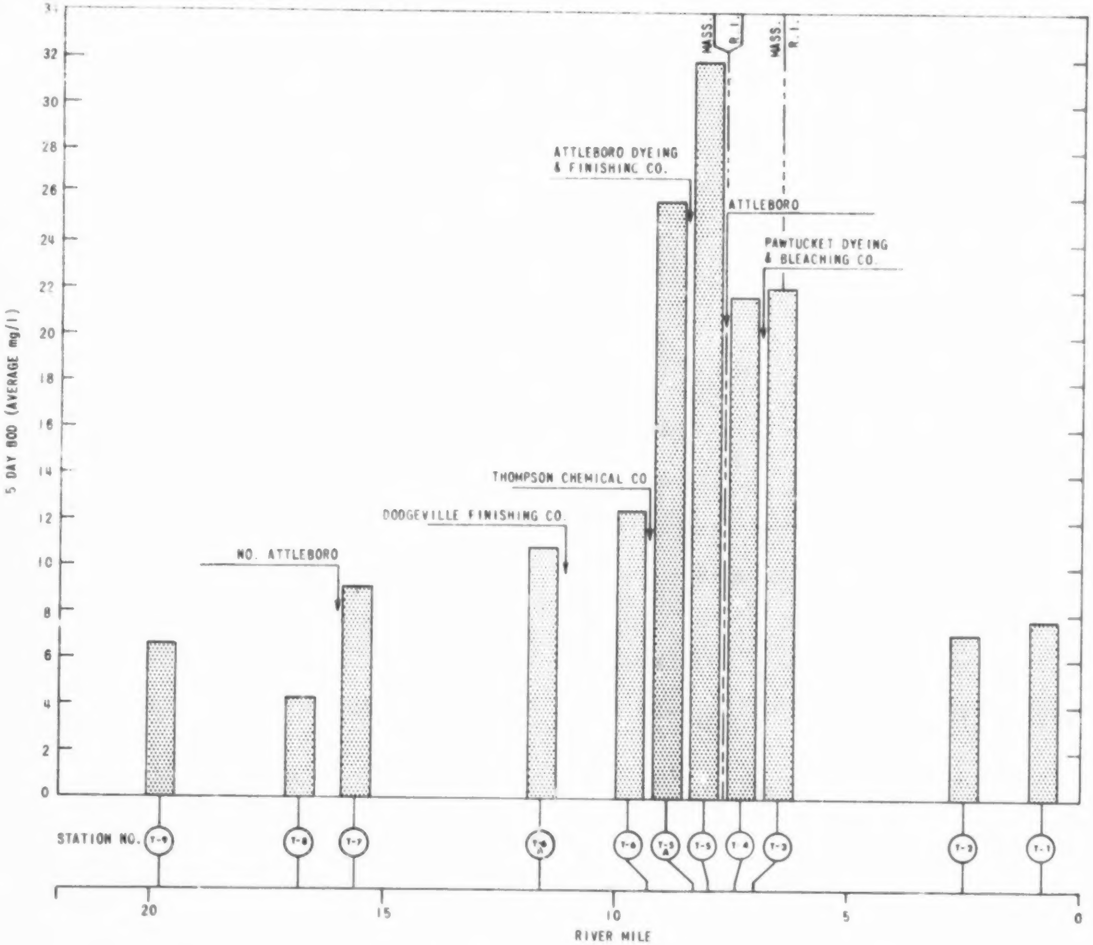


Figure No. 15. 5-DAY BIOCHEMICAL OXYGEN DEMAND (BOD) - TEN MILE RIVER - AUGUST 1964

Dissolved Oxygen

The extent to which these wastes discharges removed dissolved oxygen from the river and created local and interstate pollution problems is illustrated in Figure 16.

The river was practically saturated (8.9 mg/1) with dissolved oxygen upstream from the North Attleboro sewage treatment plant. At station T-6, 0.3 mile downstream, where the volume of treated sewage was 50 percent of the total river discharge, the dissolved oxygen of the Ten Mile River was severely reduced below the 5 mg/1 objective to an average of 1.2 and a minimum of 0.2 mg/1.

Downstream the river flowed through a series of ponds containing prolific algal growths, which produced and released oxygen into the water during daylight hours, and conversely removed dissolved oxygen from the waters at night. Dissolved oxygen information, collected during the routine survey which was conducted during daytime hours, is shown on Figure 16.[1]

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[1] Nighttime DO's observed during the special 48-hour, around-the-clock survey are included in the Appendix, Tables 28 and 29.

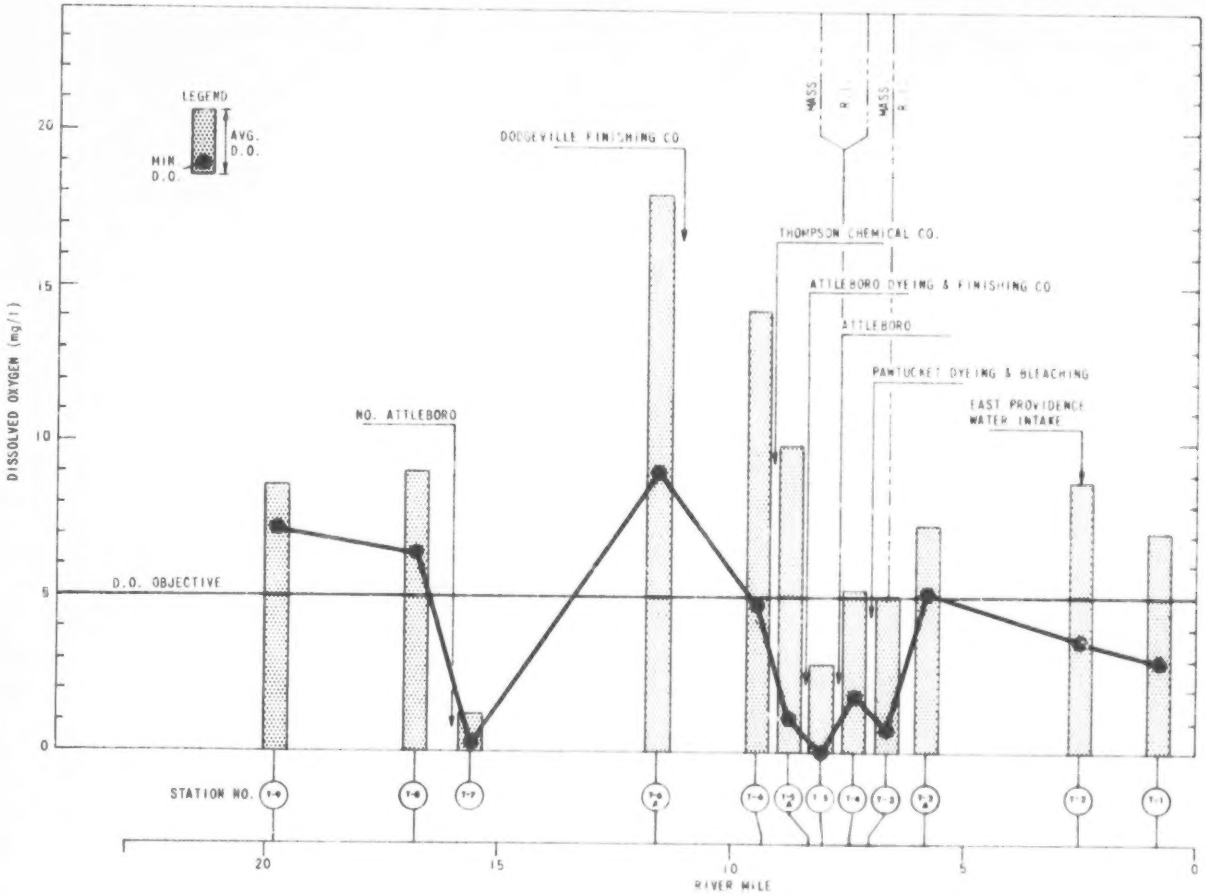

Figure No. 16. DISSOLVED OXYGEN - TEN MILE RIVER - AUGUST 1964
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At the next three stations, in the pools above Dodgeville pond dam, the Hebronville dam, and the dam at Attleboro Dyeing and Finishing Company, the river was supersaturated with oxygen produced by algae during a portion of the daytime hours. The minimum daytime DO's, however, were reduced to 4.7 mg/l at the Hebronville dam below Dodgeville Finishing Company, and to 1.1 mg/l at the Attleboro Dyeing and Finishing Company dam, located below Thompson Chemical Company.

Between Attleboro Dyeing and Finishing Company and the Attleboro sewage treatment plant, 0.3 mile above the first State line, the DO averaged 2.8 mg/l, and was depressed to a minimum of zero during the daylight hours. At the third State line, at the Central Avenue bridge, DO of the water flowing into Rhode Island averaged 5 mg/l, but the daytime minimum was 0.7, and the nighttime minimum was zero mg/l.

An additional set of samples were collected at approximately 4-hour intervals during a special 48-hour around-the-clock DO study (Table 28). The average DO's of these determinations were reduced from 8.3 mg/l at the dam above the Attleboro Dyeing and Finishing Company, to 4.1 mg/l below Attleboro Dyeing and Finishing Company, to 3.3 mg/l below the Attleboro sewage treatment plant, and to 2.0 mg/l at the State line at Central Avenue below the Pawtucket

Dyeing and Bleaching Company. The minimum DO's in this series were 2.4 above and 0.6 below Attleboro Dyeing and Finishing Company and 0.0 at each of the two other downstream stations.

Average dissolved oxygen concentrations exceeded 5 mg/l at the Pawtucket Golf Club dam, about 2 miles below the State line, and throughout the next six miles to the mouth. The minimum DO concentrations were reduced to 3.6 at the East Providence Water Works intake and 2.9 at the Roger Williams Avenue bridge, 0.8 mile upstream from the mouth.

Wastes from the Dodgeville Finishing Company, Thompson Chemical Company, Attleboro Dyeing and Finishing Company, an unidentified source below Attleboro Dyeing and Finishing Company, and effluent from the Attleboro sewage treatment plant, all located in Massachusetts, and the Pawtucket Dyeing and Bleaching Company, located in Rhode Island, polluted the interstate reach of Ten Mile River, and were responsible for the removal of dissolved oxygen from the river waters, which produced conditions intolerable to desirable fish and aquatic life in the interstate Ten Mile River flowing across the State lines into Rhode Island.

AESTHETIC CONSIDERATIONS

The adverse effects of floating solids on the beauty of the Blackstone River have already been mentioned. Other floating and suspended materials, such as slimes and refuse, are further evidence that the Blackstone and Ten Mile Rivers are badly polluted. Household-type detergents in sewage and commercial-type detergents in industrial wastes generated unsightly foam, that billowed on the water surface and scudded through the air above the turbulent Blackstone River, below the dams, from Northbridge, Massachusetts, to Central Falls, Rhode Island. The amount of common household detergent, (ABS (alkyl benzene sulfonate) in the river waters is shown in Table 35. These values do not include the undetermined amount of phosphorus base commercial-type detergents normally used in commercial laundries and textile mill operations. In addition, the Blackstone River contains masses of floating wool fibers and has a dark grey color, typical of organic pollution, that renders its appearance unsightly.

Wastes from Stamina Mills and primarily from the Branch River Wool Combing Company defiled the Branch River, and were responsible for the river's nauseating appearance from Branch Village to its confluence with the Blackstone River.

Various objectionable unnatural colors attributable to industrial wastes are intermittently displayed in Ten Mile

River. Unsightly sludges, slimes, and excessive aquatic vegetation were apparent in the State line reach.

SUMMARY AND CONCLUSIONS

1. On the basis of reports, surveys, or studies, having reason to believe that pollution from sources in Massachusetts and Rhode Island was endangering the health or welfare of persons in Rhode Island and Massachusetts, and in accordance with Section 8 of the Federal Water Pollution Control Act, the Secretary of Health, Education, and Welfare called this conference of the State and interstate water pollution control agencies and the Department of Health, Education, and Welfare in the matter of pollution of the interstate waters of the Blackstone and Ten Mile Rivers and their tributaries.

2. The Blackstone River begins in the southern part of Worcester, Massachusetts, and flows in a southeasterly direction for 42 miles to Pawtucket, Rhode Island, then southerly for 7 miles to its mouth at the Seekonk River. Principal tributaries include the Mumford and West Rivers from Massachusetts, and the Branch River from Rhode Island.

The Ten Mile River begins in Plainville, Massachusetts, and follows an irregular, but generally southerly, course for a distance of 21 miles where it, too, joins the Seekonk River in Rhode Island.

3. Although the Blackstone River and the Ten Mile River in the region of the Massachusetts-Rhode Island State line are considered Class D on the basis of present water quality, both have been assigned a Class C for future highest use by the New England Interstate Water Pollution Control Commission. (See Table 42 for NEIWPCC Classification and Standards of Water Quality.)

4. Although fishing is presently severely limited by pollution, a suitable warm water fish population would develop in both the Blackstone and Ten Mile Rivers if pollution did not exist.

5. Raw and partially treated sewage, discharged to the Blackstone River within the 40-mile surveyed reach, from the U.S. Highway 20 bridge in Worcester, Massachusetts, to the Broad Street bridge at the northern limits of Central Falls, Rhode Island, contained 141,000 bacterial population equivalent (BPE) of coliform bacteria. Sixty-seven percent of the bacterial pollution originated in Massachusetts and 33 percent in Rhode Island.

At this time I would call your attention to a line which was deleted from the report in typing the final draft. The following paragraph should read as follows:

Of the total sewage discharged within the surveyed reach, 90,000 BPE or 64 percent came from Worcester, Massachusetts; 45,000 BPE or 32 percent from Woonsocket, Rhode Island; and 6,000 BPE or 4 percent from the other 10 smaller jurisdictions located along the river.

Although Worcester sewage received secondary treatment, the effluent was not chlorinated and the plant capacity was inadequate to abate stream pollution. Woonsocket raw sewage was bypassed directly to the river during August while construction of additional treatment units and new chlorination facilities were nearing completion.

Raw and treated sewage, discharged to Ten Mile River, contained 2,400 BPE of coliform bacteria, of which more than 99 percent originated in Massachusetts. Of this total, 2,100 BPE or 88 percent came from Attleboro, Massachusetts, and 300 BPE or 12 percent was included in domestic sewage from industrial plants.

The North Attleboro secondary sewage treatment plant effluent was chlorinated to achieve more than 99.9 percent bacterial removal. Construction of additional treatment facilities and new chlorination facilities at the Attleboro sewage plant was nearing completion in August. Partial treatment by the existing Attleboro sewage plant removed only 88 percent of the bacteria and was not adequate to abate bacterial pollution of Ten Mile River.

6. The Blackstone River was polluted by the oxygen-demanding constituents of sewage and industrial wastes. Forty-two percent of the 219,000 population equivalent total was included in raw and treated municipal sewage and 58 percent in industrial wastes discharged to the river. Forty-two percent of the total oxygen demand from sewage and industrial wastes originated in Massachusetts and 58 percent in Rhode Island.

Woonsocket, Rhode Island, and Worcester, Massachusetts, were almost equally responsible for most of the oxygen demand load contained in sewage: 45,000 population equivalent (PE) or 48 percent came from Woonsocket; 40,000 PE or 43 percent came from Worcester; and 8,000 PE or 9 percent came from the other 10 jurisdictions listed in this report.

Forty-six percent of the oxygen demand in the 126,000 population equivalent total industrial waste load was discharged by Woonsocket industries. The Branch River Wool Combing Company, discharging 14 percent of the total, was the largest single industrial source of oxygen demand.

Approximately 38 percent of the total industrial waste load was discharged by the following 9 industries:

Hayward Schuster Woolen Mills	10%
Felters Company	8%
Hayward Woolens	5%
Stanley Woolen Mills	4%
Emile Bernat Company	3%
Manville Industries	3%
J. J. O'Donnell Woolens	2%
Stamina Mills	2%
W & S Laundry	1%

Six other industries listed in this report, discharging from 0.2 percent to 0.6 percent each, contributed approximately 2.0 percent of the load.

Eighty-three percent of the 38,000 PE oxygen demand entering Ten Mile River was included in industrial wastes and 17 percent in sewage. More than half (58%) of the total combined industrial and municipal demand came from Thompson Chemical Company, 15 percent from Attleboro Dyeing and Finishing Company, 14 percent from Attleboro sewage, 6 percent from Dodgeville Finishing Company, 5 percent from Pawtucket Dyeing and Finishing Company, and 2 percent from North Attleboro sewage. Ninety-five (95) percent of this demand originated in Massachusetts and 5 percent in Rhode Island.

7. Bacteria in the raw and partially treated sewage, from both Massachusetts and Rhode Island, polluted the Blackstone River and endangered the health of all persons who might come in contact with the river waters throughout the entire 40-mile reach covered by the August 1964 survey. The total coliform objectives for water contact sports and general recreational use were exceeded at every sampling station from Worcester, Massachusetts, to Central Falls, Rhode Island.

Local waters below Worcester contained 8.5 million MPN of total coliform per 100 ml of water and those below Woonsocket contained 7.5 million per 100 ml. At these two locations the river contained more than one-third as many total coliform bacteria as can be expected in raw municipal sewage.

The interstate waters, flowing across the State line from Massachusetts into Rhode Island contained a median MPN of 51,500 total coliform bacteria per 100 ml and exceeded the 5,000 general recreation limiting objective by 10 times and the 1,000 Rhode Island water contact sport limiting objective by 50 times.

Sewage-associated bacteria polluted the interstate waters of Ten Mile River and presented a serious hazard to persons, especially children who may come in contact with the river while playing and wading in the river. Sewage discharges, primarily the unchlorinated effluent from the Attleboro sewage treatment plant in Massachusetts, increased the total coliform density to 7.5 million MPN per 100 ml at the State line. This astronomical coliform density was 1,500 times the general recreation objective, 7,500 times the water contact use objective and more than one-third the average coliform density of raw sewage.

8. A study of bottom organisms of the Blackstone River showed stream degradation from wastes originating in Worcester, Massachusetts, and with additional waste contributions in downstream reaches, the polluted bottom conditions extended through Woonsocket, Rhode Island. The Blackstone River receives polluted water from the Mumford River in Massachusetts, and in the region of the State line, from the Branch River in Rhode Island. Pollution from Woonsocket further degraded the stream below this point.

Ten Mile River was severely degraded by pollution from below Whiting Pond in North Attleboro, Massachusetts, to the point where it joins the Seekonk River in East Providence, Rhode Island. At the Massachusetts-Rhode Island State line, sludge deposits and slime growths were evident, and aquatic animal life was limited to those tolerant organisms that could withstand a polluted environment.

Presently, all fishery pursuits are severely limited by pollution on both the Blackstone and Ten Mile Rivers. A few fish are taken, mostly carp and suckers.

9. When the dissolved oxygen (DO) of a river is reduced below an adequate level, fish and the aquatic life on which fish feed are killed or driven out of the area. Both Massachusetts and Rhode Island have adopted 5 milligrams per liter (mg/l) of DO as one of the minimum water quality standards to maintain a suitable habitat for fishes indigenous to the region (Class C waters).

The oxygen demand of sewage and industrial wastes from Massachusetts and Rhode Island at times removed practically all dissolved oxygen from local reaches of the Blackstone River.

Wastes from the Branch River Wool Combing Company in Rhode Island in combination with the BOD residual from Massachusetts polluted the interstate waters of the Blackstone River and reduced its dissolved oxygen content below the objective for fish and aquatic life as it crossed the second State line into the Massachusetts loop at Blackstone, Massachusetts. At Bridge Street in Blackstone, Massachusetts, the DO averaged 3.5 mg/l, the minimum was 2.3, and 70 percent of all samples collected contained less than the 5.0 mg/l objective.

The oxygen demand of sewage and industrial wastes entering the river in Massachusetts polluted and, at times, removed all dissolved oxygen from the interstate reach of Ten Mile River flowing across the State lines and into Rhode Island. Water quality was degraded below the minimum requirements for fish and other desirable aquatic life by wastes from the Dodgeville Finishing Company, Thompson Chemical Company, Attleboro Dyeing and Finishing Company, an unidentified intermediate source, and the effluent from the Attleboro sewage treatment plant, all in Massachusetts, and the Pawtucket Dyeing and Bleaching Company, in Rhode Island.

10. Floating and suspended slimes, wool fibers, foam, greases, and other obnoxious refuse from sewage and industrial waste discharges in Massachusetts and Rhode Island were responsible for the offensive appearance of local and interstate reaches of the Blackstone and Ten Mile Rivers.

11. Sewage and industrial wastes discharged to the interstate waters of the Blackstone and Ten Mile Rivers and their tributaries in Massachusetts cause pollution that endangers the health or welfare of persons in Rhode Island; and industrial wastes discharged to the Branch River in Rhode Island and industrial wastes originating in Rhode Island and discharged to the Ten Mile River in Massachusetts cause pollution that endangers health or welfare of persons in

Massachusetts, and therefore are subject to abatement under the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 466 et seq.).

Thank you.

Table 1
Sampling and Reference Point Location
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station Number	River Mile	Description
Blackstone River		
--	49	Tatmuck Brook enters.
-*	47.9	Millbury St., Worcester, Mass.
B-14	46.9	U.S. Rt. 20 Bridge
-	46.6	Worcester, Mass. Sewage Treatment Plant.
- *	46.1	Below Worcester Sewage Treatment Plant.
B-13	46.0	Mass. Rt. 146 Bridge.
	44.8	The Felters Co., Millbury, Mass.
-	43.7	W. W. Windle Wool Scouring Co., Millbury
-	43.7	A. D. Windle Wool Scouring Co., Millbury
-	43.8 to 44.7	Millbury Sewage.
-	42.2	Dam, Sagdaw Storage Co.
-	42.1	Snidar Packing Co.
-	41.2	Dam, Saundersville.
B-12*	40.5	Pleasant St. Bridge., Saundersville, Mass.
	39.7+	Quinsigamond River enters.
B-11E	39.7	Above Fisherville Dam.
-	39.7-	Dam, Fisher Mfg. Co.
B-11D	39.5	Mass. Rt. 122A Bridge., Fisherville, Mass.
B-11C	39.0	Above Farmumsville Dam.
-	38.9	Dam at Farmumsville.
B-11B	38.8	Ferry St. Bridge., Farmumsville, Mass.

* Indicates Biological Sampling Station.

Table 1
Sampling and Reference Point Location
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station Number	River Mile	Description
Blackstone River (cont.)		
	38.8-	O'Donnell Woolens, Inc., Farmumsville, Mass.
B-11A	36.9+	Above Dam off Main St., Northbridge, Mass.
	36.9	Dam above Northbridge, Northbridge, Mass.
-	36.8+	Coz Chemical, Northbridge, Mass.
B-11 *	36.8	Sutton St. Bridge., Northbridge, Mass.
-	36.7	U.S.G.S. Gage., Northbridge, Mass.
B-10C	35.0+	Above Dam, Riverdale, Mass.
-	35.0	Dam, Kupfer Bros. (Riverdale)
B-10B	35.0-	Below Dam.
B-10A *	34.1	Church St. Bridge
-	32.4	Northbridge Sewage Treatment Plant effluent.
B-10	31.3	Hartford Rd. Bridge
	31.3-	Dam forming Rice City Pond.
-	30.0	Stanley Woolen Co., Uxbridge, Mass.
B-9	29.9+	Mass. Rt. 16 Bridge (Mendon St.), Uxbridge, Mass.
- *	29.9	Above confluence with Mumford River.
-	29.5	Mumford River enters.
-	28.7	West River enters.
B-8A *	27.7	Mass. Rt. 122 Bridge
- *	26.0	Power line above Millville, Mass.

* Indicates Biological Sampling Station.

Table 1
Sampling and Reference Point Location
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station Number	River Mile	Description
Blackstone River (cont.)		
B-8	24.5	Central St. Bridge, Millville
-	24.3	Blackstone Wool Scouring Co.
-	24.0	Millville Sewage.
-	23.7	Upper reach Lonsdale Dam.
B-7A	22.4	Dam, Lonsdale Co.
B-7 *	22.3	Mass.-Rhode Island State line
B-7B	22.0	Immediately above confluence with Branch River.
-	21.9	Branch River enters.
- *	21.7	Below confluence with Branch River.
-	21.3	Rhode Island-Mass. State line.
B-6	21.0	Bridge St., Blackstone, Mass.
-	20.4	Mass.-Rhode Island State line.
B-5 *	20.0	Singleton St. Bridge, Woonsocket, R. I.
-	18.7	Dam, Woonsocket Falls
-	18.3	Bernon Dam, Woonsocket, R. I.
-	17.6	U.S.G.S. Gage
B-4	17.2	Hamlet St. Bridge, Woonsocket, R. I.
-	16.9	Woonsocket, R. I. Sewage Treatment Plant
- *	16.5	Woonsocket, R. I. City Dump
- *	15.0	Below Woonsocket, R. I. Water Treatment Plant.

* Indicates Biological Sampling Station.

Table 1
Sampling and Reference Point Location
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station Number	River Mile	Description
Blackstone River (cont.)		
B-3	14.7	Above Manville Dam.
	14.7-	Manville Dam.
B-3A *	14.6	Rhode Island 120 Bridge (below Dam).
	14.5	Manville Sewage
-	12.9	Albion Dam
	12.7	Albion Sewage
B-2	11.4+	Above Ashton Dam
	11.4	Ashton Dam
- *	11.3	Below Ashton Dam
	11.0	Ashton Sewage
- *	10.3+	Above Berkeley Rd. Bridge.
- *	10.3-	Below Berkeley Rd. Bridge.
	10.0	Berkly Sewage
-	9.0	Lonsdale Dam
- *	7.9	Front St. Bridge, Lonsdale, Rhode Island
B-1	6.9	Broad St. Bridge
-	6.8	Sayles Finishing Co. Dam
-	5.8	Central Falls Dam
-	5.1	Old Slater Mill Dam
-	5.0	B.V.G.&E. Co. Dam
-	0.0	5 mi. below B.V.G.&E. Co. Dam (confl. Seekonk & Providence River

* Indicates Biological Sampling Station.

Table 1
Sampling and Reference Point Location
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station Number	River Mile	Description
Blackstone River Tributaries		
Tatnuck Brook enters Blackstone River at B-49.0		
- *	9.6	Tatnuck Brook
	0.0	Mouth
Quinsigamond River enters Blackstone River at B-39.7+		
-	5.6	U.S.G.S. Gage
Q-1	1.8	Church St. Bridge, Grafton, Mass.
-	0.0	Mouth
Mumford River enters Blackstone River at B-29.5		
- *	11.6	Oxford-East Douglas St. Bridge (E. of Manchaug)
M-4*	10.2	Manchaug St. Bridge (West of E. Douglas)
-	9.1	Hayward Woolen Co. (Div. of Einiger Corp.), E. Douglas.
- *	8.0	Above Hayward Schuster Woolen Mills, Inc.
-	7.9	Hayward Schuster Woolen Mills, Inc.
- *	7.4	Below Hayward Schuster Woolen Mills, Inc.
M-3	5.6+	Above Lackey Dam
-	5.6	Lackey Dam
- *	4.8	Whitinsville, Mass.
- *	1.2	Between Uxbridge. & No. Uxbridge, Mass.
M-2	0.5+	Above Uxbridge Dam
-	0.5	Dam at Uxbridge (above Douglas St.)

* Indicates Biological Sampling Station.

Table 1
Sampling and Reference Point Location
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station Number	River Mile	Description
Blackstone River Tributaries		
Mumford River (cont.)		
-	0.5-0.4	Uxbridge Sewage
-	0.4	Emile Bernat Co., Uxbridge, Mass.
M-1 *	0.4	Depot St. Bridge , Uxbridge, Mass.
-	0.0	Mouth
West River enters Blackstone River at B-28.7		
-	3.5	U.S.G.S. Gage
-	1.7	Waucuntuck Woolen Mills, Inc., Wheelockville, Mass.
W-1*	0.6	Hecla St. Bridge, Centerville, Mass.
-	0.0	Mouth
Branch River enters Blackstone River at B-21.9		
- *	10.0	Chepachet River enters
- *	6.0	Nasonville Bridge
BR-2 *	2.6	Providence Rd. Bridge (headrace from Slatersville Reservoirs)
-	1.7	Stamina Mills , Forestdale, R. I.
-	1.6	U.S.G.S. Gage , Forestdale, R. I.
BR-1A *	1.1	Between Stamina Mills & Branch River Wool Combing Co.
-	0.9	Branch River Wool Combing Co., Branch Village, R.I.
BR-1 *	0.8	Mass. Rt. 146 Bridge, Branch Village, R. I.
-	0.0	Mouth

* Indicates Biological Sampling Station.

Table 1
Sampling and Reference Point Location
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station Number	River Mile	Description
Ten Mile River		
T-9 *	19.8	Whiting Pond
	19.8-	Whiting Pond Dam
- *	19.6	Below Whiting Pond
- *	18.5	First Bridge above Coral Lake
T-8 *	16.8	Freeman St. Bridge above North Attleboro Sewage Treatment Plant.
-	15.9	North Attleboro Sewage Treatment Plant
T-7 *	15.6	Deanville Rd. Bridge
- *	13.1	Maple St. Bridge, Attleboro, Mass.
T-6A *	11.6	Tiffany St. Bridge
	11.6-	Dodgeville Pond Dam
-	11.5	Dodgeville Finishing Co.
T-6	9.3	Above Hebronville Dam
-	9.3-	Hebronville Dam
- *	9.2	Thompson Chemical Co.
-	8.3	Pond St. Bridge
T-5A	8.2	Above Attleboro Dyeing & Finishing Co. Dam
-	8.2-	Attleboro Dyeing & Finishing Co. Dam
- *	8.1	Attleboro Dyeing & Finishing Co. Unnamed tributary enters.
T-5 *	8.0	Above Attleboro Sewage Treatment Plant
-	7.8	Attleboro Sewage Treatment Plant
- *	7.7+	Above Mass.-Rhode Island State line.
	7.7	Mass.-Rhode Island State line.
-	7.6	Seven Mile River enters.
-	7.4+	Pawtucket Dyeing & Blackstone River intake.
-	7.4	Rhode Island-Mass. State line

* Indicates Biological Sampling Station.

Table 1
Sampling and Reference Point Location
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station Number	River Mile	Description
Ten Mile River (cont.)		
-	7.2	Pawtucket Dyeing & Bleaching Co.
- *	7.15	Below Pawtucket Dyeing & Bleaching Co.
T-3 *	7.0	Mass.-Rhode Island State line - Central Ave. Bridge
T-2A	5.8+	Above Dam at Pawtucket Golf Club
-	5.8	Dam at Pawtucket Golf Club
- *	5.8-	Armistice Ave. Bridge
T-2	2.5+	East Providence Waterworks Intake - above Reservoir Dam.
-	2.5	East Providence Waterworks Dam
- *	2.2	Fall River Ave. Bridge
-*	0.8+	North Broadway St. Bridge
T-1	0.8	Roger Williams Ave. Bridge
-	0.0	Mouth (N.Y.-N.H. R.R. Bridge)
- *	8.0-0.5	Unnamed tributary to Ten Mile River

* Indicates Biological Sampling Station.

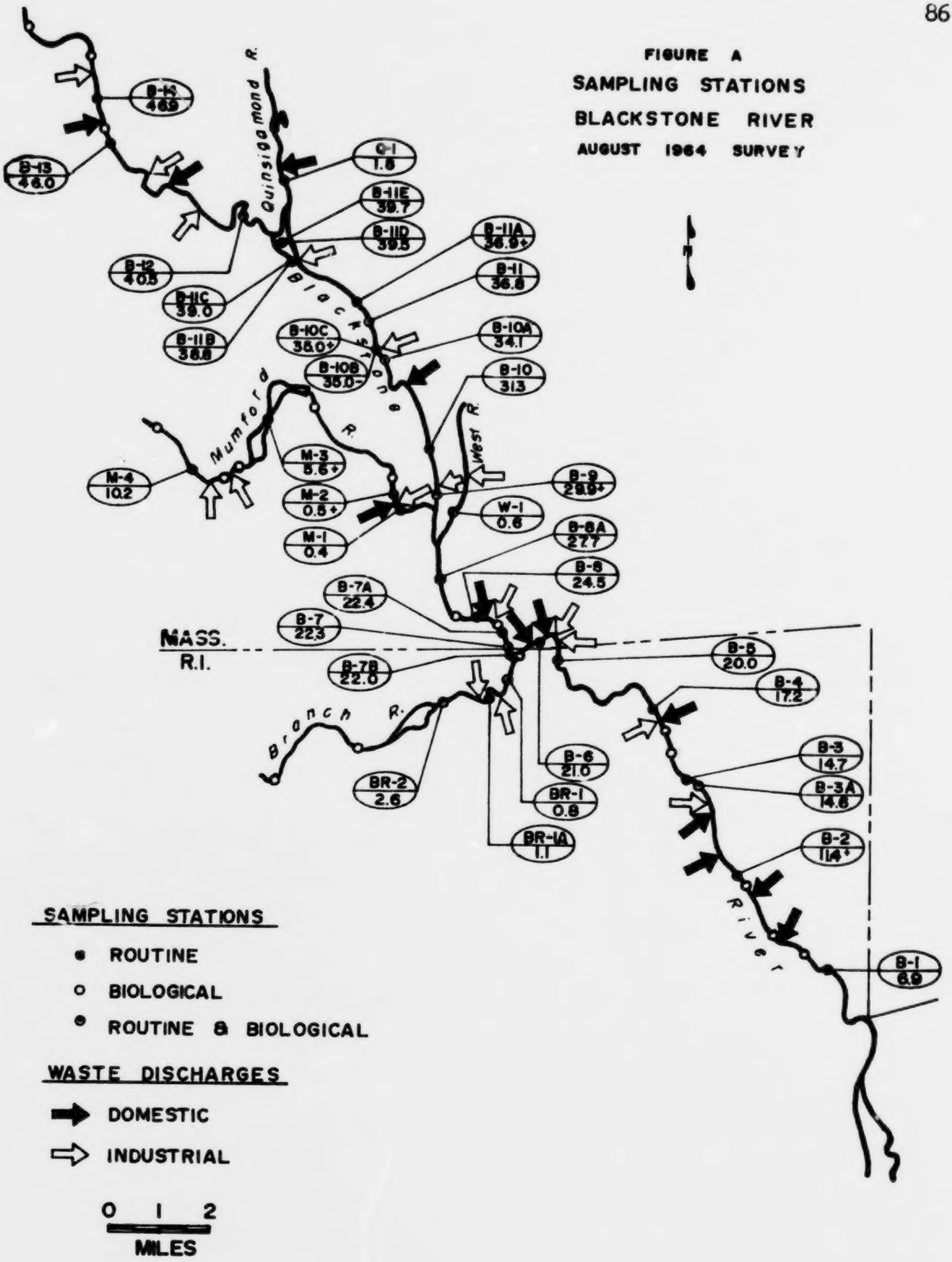

FIGURE A
SAMPLING STATIONS
BLACKSTONE RIVER
AUGUST 1964 SURVEY

B-14 46.9
B-13 46.0
Quinsigamond R.
Q-1 1.8
B-11E 39.7
B-11D 39.5
B-11A 36.9+
B-12 40.5
B-11 36.8
B-11C 39.0
B-11B 38.8
Blackstone
B-10C 36.0+
B-10A 34.1
B-10B 35.0-
B-10 31.3
Mumford R.
West R.
M-3 5.6+
M-4 10.2
M-2 0.5+
B-9 29.9+
W-1 0.6
M-1 0.4
B-8A 27.7
B-8 24.5
B-7A 22.4
B-7 22.3
MASS.
R.I.
B-5 20.0
B-7B 22.0
B-4 17.2
Branch R.
B-6 21.0
B-3 14.7
B-3A 14.6
BR-2 2.6
BR-1 0.8
BR-1A 1.1
B-2 11.4+
River
B-1 6.9
SAMPLING STATIONS
● ROUTINE
○ BIOLOGICAL
◉ ROUTINE & BIOLOGICAL
WASTE DISCHARGES
➡ DOMESTIC
⇨ INDUSTRIAL
0 1 2
MILES

FIGURE 8

SAMPLING STATIONS
TEN MILE RIVER
AUGUST 1964 SURVEY

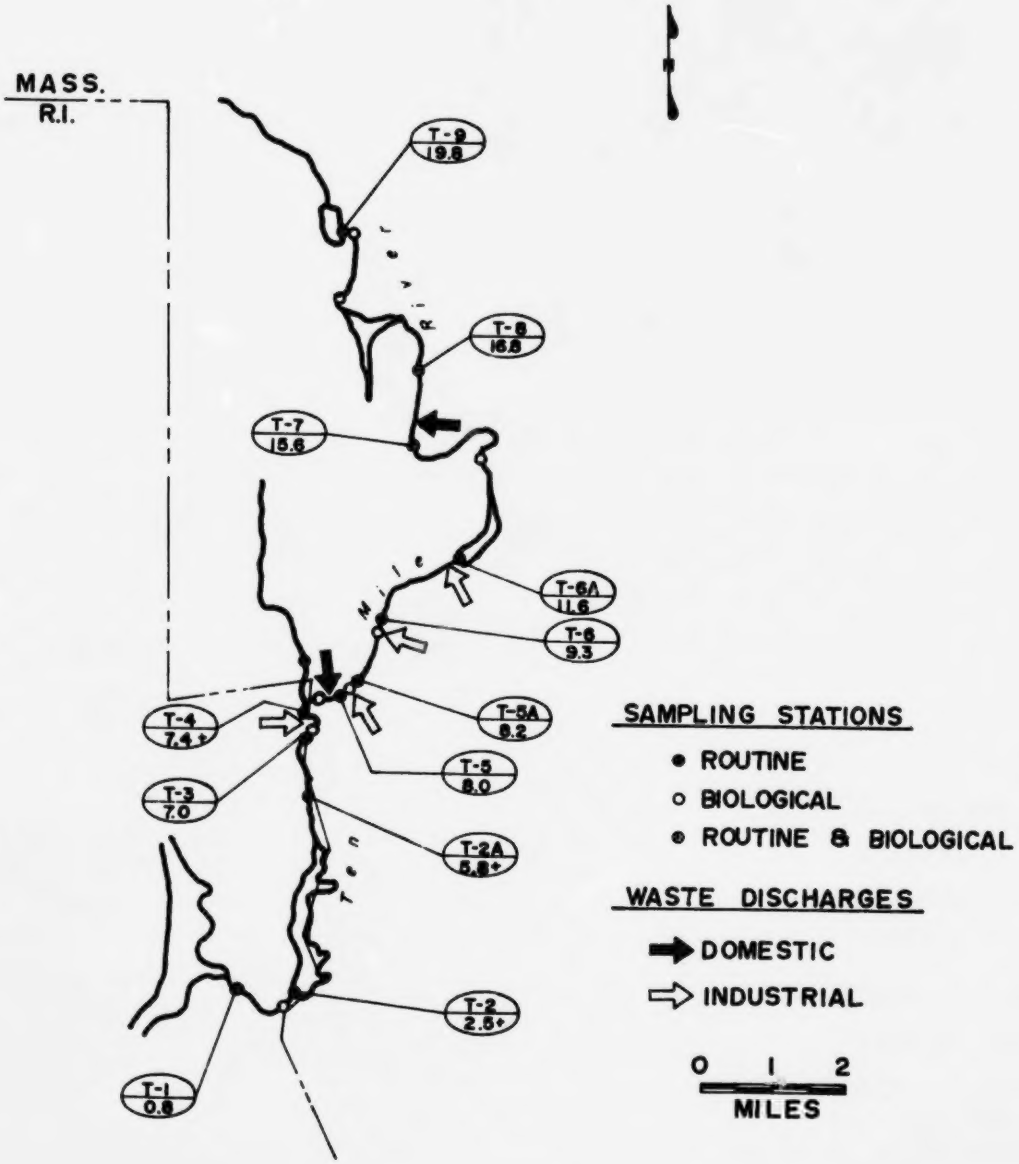
MASS.
R.I.
River
Mile
Ten
T-9 19.8
T-8 16.8
T-7 15.6
T-6A 11.6
T-6 9.3
T-5A 8.2
T-5 8.0
T-4 7.4+
T-3 7.0
T-2A 5.8+
T-2 2.5+
T-1 0.8
SAMPLING STATIONS
● ROUTINE
○ BIOLOGICAL
◉ ROUTINE & BIOLOGICAL
WASTE DISCHARGES
DOMESTIC
INDUSTRIAL
0 1 2
MILES

Table 2
Sources of Sewage
Blackstone River
August, 1964 Survey

MUNICIPALITY	Location River Mile	Type of System 1)	TREATMENT	Population Served		ESTIMATED POPULATION EQUIVALENTS DISCHARGED					
						BACTERIAL		OXYGEN DEMAND		SUSPENDED SOLIDS	
				Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
Massachusetts											
Worcester	46.6	SC	Secondary	180,000	76.3	90,000	64.0	40,200	43.5	48,800	49.3
Millbury	43.8 to 44.7	C	None	1,200	0.5	1,200	0.9	1,200	1.3	1,200	1.2
Grafton	39.7-2.4	*	None	1,000	0.4	1,000	0.7	1,000	1.1	1,000	1.0
Northbridge	32.4	S	Secondary	6,000	2.5	450	0.3	2,500	2.7	280	0.3
Uxbridge	29.5-0.5	*	None	500	0.2	500	0.4	500	0.5	500	0.5
Millville	24.0	*	None	400	0.2	400	0.3	400	0.4	400	0.4
Blackstone	20.5 to 21.2	*	None	500	0.2	500	0.4	500	0.5	500	0.5
	Massachusetts Total			189,600	80.3	94,050	67.0	46,300	50.0	52,680	53.2
Rhode Island											
Woonsocket	16.9	S	(See note)	45,000	19.1	45,000	32.0	45,000	48.5	45,000	45.5
Manville	14.5	S	None	700	0.3	700	0.5	700	0.8	700	0.7
Albion	12.7	C	None	300	0.1	300	0.2	300	0.3	300	0.3
Ashton	11.0	C	None	140	0.1	140	0.1	140	0.2	140	0.1
Berkeley	10.0	C	None	230	0.1	230	0.2	230	0.2	230	0.2
	Rhode Island Total			46,370	19.7	46,370	33.0	46,370	50.0	46,370	46.8
	GRAND TOTAL			235,970	100.0	140,420	100.0	92,670	100.0	99,050	100.0

Note: Woonsocket, R.I. raw sewage was bypassed directly to the river during the August, 1964 survey while additional municipal sewage treatment facilities, nearing completion, were under construction. This pollutional load will be reduced when the treatment plant is restored to full operation.

1) S = Separate sanitary sewers.
C = Combined, sanitary and storm sewers.
* = Private sewer outlets and connections to private storm drains.

Table 3
Sources of Sewage
Ten Mile River
August, 1964 Survey

MUNICIPALITY	Location River Mile	Type of System	TREATMENT	Population Served		ESTIMATED POPULATION EQUIVALENTS DISCHARGED					
						BACTERIAL		OXYGEN DEMAND		SUSPENDED SOLIDS	
				Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
Massachusetts											
North Attleboro	15.9	S	Secondary, Sand Filters, Chlorination.	7,800	33	5	0+	840	13	380	12
Attleboro (1)	7.8	S	Sand Filters	16,000	67	2,100	100-	5,500	87	2,800	88
Massachusetts Total				23,800	100	2,105	100	6,340	100	3,180	100

(1) Based on three total coliform and 5-day B.O.D. tests of plant effluent, during the 1964 survey, when raw sewage was applied directly to sand filters without chlorination. Suspended solids in effluent assumed to approximate one-half of B.O.D. loading. This pollutional load to the river will be reduced when trickling filters, chlorination facilities, etc., which were under construction during the survey, are completed.

Note: No sewered discharged in Rhode Island section of survey area.

Table 4
Sources of Industrial Wastes
Blackstone River
August, 1964 Survey

			ESTIMATED POPULATION EQUIVALENTS DISCHARGED					
			BACTERIAL		OXYGEN DEMAND		SUSPENDED SOLIDS	
INDUSTRY	TYPE	Location River Mile	Number	Percent of total	Number	Percent of total	Number	Percent of total
Massachusetts								
The Felters Co.	Felt Dyeing	44.8	67	3.8	9,900	7.9	250	0.4
A. D. Windle Co.	1) Wool Scouring	43.7	19	1.1	700	0.6	980	1.6
W. W. Windle Co.	1) Wool Scouring	43.7	19	1.1	700	0.6	980	1.6
Snider Bros., Inc.	Meat Packing	42.1	50	2.8	300	0.2	300	0.5
J. J. O'Donnell Woolens, Inc.	Woolen Mill	38.8-	77	4.4	2,450	1.9	550	0.9
Kupfer Brothers Co.	Paper Coating Printing	35.0	47	2.7	neg.	neg.	neg.	neg.
Hayward Woolen Co. (Div. Einiger Corp.)	Wool Dyeing, Finishing	29.5-9.1	133	7.6	6,800	5.4	neg.	neg.
Hayward Schuster Woolen Mills, Inc.	Wool Dyeing, Finishing	29.5-7.9	167	9.5	12,000	9.5	6,750	11.0
Emile Bernat Co.	Wool Dyeing, Finishing	29.5-0.4	147	8.4	3,220	2.6	1,280	2.1
Stanley Woolen Co.	Wool Dyeing, Finishing	30.0	47	2.7	5,390	4.3	580	1.0
Waucantuck Mills	Wool Dyeing, Finishing	28.7-1.7	117	6.7	390	0.3	130	0.2
Blackstone Wool Co.	Scouring Alpaca, Mohair	24.3	12	0.7	270	0.2	1,050	1.7
Blackstone Potato Chip Co.	Potato Chips	20.6	15	0.9	780	0.6	960	1.5
W. & S. Laundry	Laundry	20.5	15	0.9	1,670	1.3	580	1.0
Massachusetts total			932	53.3	44,570	35.4	14,390	23.5
Rhode Island								
Stamina Mills	Wool Dyeing Finishing	21.9-1.7	150	8.6	2,500	2.0	1,000	1.6
Branch River Wool Combing Co., Inc.	Wool Scouring	21.9-0.9	167	9.5	18,000	14.3	15,000	24.5
Woonsocket - 10 industries	Textiles, Misc.	19.8 to 16.8	477	27.3	57,400	45.5	29,900	48.8
Manville Industry	Woolen Mill	14.5	23	1.3	3,500	2.8	1,000	1.6
Rhode Island total			817	46.7	81,400	64.6	46,900	76.5
GRAND TOTAL			1,749	100.0	125,970	100.0	61,290	100.0

1) Normally operates 3 months per year (usually Sept., Dec. & Jan.)

Table 5
Sources of Organic Industrial Wastes
Ten Mile River
August, 1964 Survey

INDUSTRY	TYPE	Location River Mile	ESTIMATED POPULATION EQUIVALENTS DISCHARGED					
			BACTERIAL		OXYGEN DEMAND		SUSPENDED SOLIDS	
			Number	Percent of total	Number	Percent of total	Number	Percent of total
Massachusetts								
Dodgeville Finishing Co.	Textiles	11.5	100	31.2	2,180	6.9	Neg.	Neg.
Thompson Chemical Co.	Plastics	9.2	175	54.5	22,000	69.8	660	21.8
Attleboro Dyeing & Finishing Co.	Textiles	8.2-	30	9.3	5,600	17.8	1,720	56.8
Massachusetts total			305	95.0	29,780	94.5	2,380	78.6
Rhode Island								
Pawtucket Dyeing & Bleaching, Inc.	Textiles	7.2	16	5.0	1,730	5.5	650	21.4
Rhode Island total			16	5.0	1,730	5.5	650	21.4
GRAND TOTAL			321	100.0	31,510	100.0	3,030	100.0

TABLE 6

SOURCES OF INORGANIC INDUSTRIAL WASTES
Ten Mile River
August 1964 Survey

INDUSTRY	PRODUCT
PLAINVILLE	
Whiting & Davis Co.	Jewelry, Handbags
Plainville Stock Co.	Jewelry
A & J Tool & Findings Co.	Jewelry, Findings
NORTH ATTLEBORO	
L. G. Balfour Corp.	Jewelry
L. S. Peterson Co.	Jewelry
C. Ray Randall Manufacturing Co.	Costume Jewelry
R. Blackington & Co.	Silver Articles
General Chain Co., Inc.	Jewelry
Quaker Silver Co.	Silver Articles
Standard Metals, Inc.	Laminated Metals
C. K. Grouse Co.	School Rings
Oscar A. Hillman & Sons	Electroplated Articles
Plante & Fontaine Co.	Jewelry
Chever, Tweedy & Co.	Jewelry
ATTLEBORO	
Shields, Inc.	Jewelry
Sweet Manufacturing Co.	Jewelry
Swank, Inc.	Jewelry
Marathon Co.	Jewelry
Mis. Co.	Chain, Findings
Robbins Co.	Jewelry

TABLE 6

SOURCES OF INORGANIC INDUSTRIAL WASTES
Ten Mile River
August 1964 Survey
(Cont'd.)

INDUSTRY	PRODUCT
ATTLEBORO(cont'd.)	
Charle Thomae & Sons	Silver Articles
Antaya Brothers	Medals
Bates & Klinke	Jewelry
O. Ed Cameron & Son	Electroplated Articles
Attleboro Electroplating	Electroplated Articles
Leavens Manufacturing Co., Inc.	Jewelry
APCO Mussberg Co.	Steel Rods, Spools
Metals & Controls Corp.	Uranium Rods
Walton & Lonsbury	Electroplated Articles
Mossberg Pressed Steel	Machinery Parts
Mt. Vernon Silver Co.	Sterling Silver Articles
R. F. Simmons Co.	Jewelry
Ripley & Gowen	Jewelry
L. G. Balfour Commercial Plant	Jewelry
L. G. Balfour Co.	Jewelry

Table 7
Total Coliform
(MPN per 100 ml)
Blackstone River
August, 1964 Survey

	Station Number	River Mile	Tuesday 8-4	Wednesday 8-5	Thursday 8-6	Friday 8-7	Monday 8-10	Tuesday 8-11	Wednesday 8-12	Thursday 8-13	Friday 8-14	Monday 8-17	No. of Sampl.	Most Probable Number	Median	Average	Maximum	Minimum
Non-intercepted Sewage																		
	B-14	46.9	79,000	>1,600,000	49,000	49,000	4,900	33,000	542,000	130,000	542,000	980,000	10	143,000	104,500	394,000	>1,600,000	4,900
Worcester Sewage																		
	B-13	46.0	>1,600,000	50,000	1,700,000	230,000	16,000,000	9,200,000	24,000,000	7,900,000	10,900,000	13,000,000	10	8,600,000	8,550,000	8,458,000	24,000,000	50,000
Millbury Sewage																		
	B-12	40.5	1,600,000	790,000	110,000	140,000	16,000,000	16,000,000	490,000	3,300,000	3,480,000	1,730,000	10	1,600,000	1,660,000	4,363,000	16,000,000	110,000
	B-11C	38.9	-	-	-	-	-	2,400,000	330,000	16,000,000	220,000	1,300,000	5	1,200,000	1,300,000	4,050,000	16,000,000	220,000
Quinsigamond River enters																		
	B-11	36.8	140,000	33,000	170,000	79,000	49,000	330,000	490,000	1,720,000	330,000	49,000	10	165,000	195,000	339,000	1,720,000	33,000
Northbridge Sewage																		
	B-10	31.3	4,900	22,000	92,000	7,000	9,400	17,000	54,200	348,000	172,000	23,000	10	31,500	28,500	[illegible]	348,000	4,900
	B-9	30.0	92,000	41,000	92,000	11,000	14,000	7,900	23,000	240,000	348,000	13,000	10	41,000	32,000	[illegible]	348,000	7,900
Mumford & West rivers enter																		
	B-8A	27.7	-	-	-	-	540,000	130,000	130,000	87,000	94,000	22,100	6	92,000	112,000	157,200	540,000	22,100
	B-8	24.5	22,000	4,000	33,000	3,900	49,000	350,000	348,000	9,000	130,000	23,000	10	33,000	28,000	97,150	350,000	3,900
Millville Sewage Mass.-Rhode Island State Line	B-7	22.3	54,000	3,900	160,000	79,000	49,000	17,000	172,000	79,000	49,000	49,000	10	61,000	51,500	71,150	172,000	3,900
Branch River enters Blackstone Sewage Rhode Island-Mass. State Line																		
	B-6	21.0	4,300	13,000	35,000	54,000	14,000	14,000	160,000	22,100	54,200	2,100	10	21,000	18,000	37,300	160,000	2,100
Blackstone Sewage Mass.-Rhode Island State Line																		
	B-5	20.0	17,000	130,000	130,000	23,000	2,200	17,000	70,000	13,000	170,000	3,300	10	28,000	20,000	57,550	170,000	2,200
Non-intercepted Woonsocket Sewers																		
	B-4	17.2	110,000	220,000	1,400,000	49,000	79,000	31,000	79,000	109,000	130,000	79,000	10	100,000	94,000	228,600	1,400,000	31,000
Woonsocket Sewage																		
	B-3	14.7	17,000,000	7,900,000	35,000,000	4,900,000	2,200,000	11,000,000	34,800,000	7,000,000	1,300,000	2,300,000	10	7,500,000	7,450,000	12,340,000	35,000,000	1,300,000
Manville Sewage																		
	B-2	11.4	220,000	79,000	2,800,000	1,100,000	110,000	250,000	230,000	240,000	1,720,000	79,000	10	865,000	230,000	680,800	2,800,000	79,000
Ashton & Berkeley Sewers																		
	B-1	6.9	280,000	79,000	540,000	330,000	3,900,000	250,000	230,000	330,000	230,000	109,000	10	260,000	255,000	585,800	3,900,000	79,000

Table 8
Total Coliform
(MPN per 100 ml)
Blackstone River Tributaries
August, 1964 Survey

	Station Number	River Mile	Tuesday 8-4	Wednesday 8-5	Thursday 8-6	Friday 8-7	Monday 8-10	Tuesday 8-11	Wednesday 8-12	Thursday 8-13	Friday 8-14	Monday 8-17	No. of Sampl.	Most Probable Number	Median	Average	Maximum	Minimum
Quinsigamond River		B-39.7																
	Q-1	1.8	7,900	35,000	7,900	17,000	-	-	-	-	-	-	4	-	12,450	16,950	35,000	7,900
Mumford River		B-29.5																
	M-4	10.2	-	1,300	7,000	230	-	-	-	-	-	-	3	-	1,300	2,840	7,000	230
Hayward (Sinigar) Woolens Hayward Schuster Woolens																		
	M-3	5.6	-	49,000	200	2,800	-	-	-	-	-	-	3	-	2,800	17,300	49,000	200
Whitinsville & Linwood																		
	M-2	0.5	6,300	11,000	13,000	49,000	110,000	79,000	130,000	109,000	79,000	33,000	10	44,500	64,000	61,900	130,000	6,300
Uxbridge Sewage																		
	M-1	0.4	540,000	330,000	220,000	170,000	250,000	330,000	130,000	221,000	230,000	49,000	10	288,000	285,000	245,000	540,000	49,000
West River		B-18.7																
	W-1	0.6	33,000	4,900	22,000	4,900	-	-	-	-	-	-	4	-	13,450	16,200	33,000	4,900
Branch River		B-21.9																
	BR-2	2.6	1,700	1,700	2,800	3,300	1,700	2,800	2,200	1,300	1,300	1,700	10	1,950	1,700	2,050	3,300	1,300
Stanton Mills Branch River Wool Combing																		
	BR-1	0.8	13,000	49,000	49,000	130,000	33,000	49,000	109,000	49,000	33,000	172,000	10	56,000	49,000	68,600	172,000	13,000
Major Discharges																		
Worcester Sewage		46.6	-	-	-	-	-	-	840,000	-	34,800,000	10,900,000	3	-	10,900,000	15,500,000	34,800,000	840,000
Branch River Wool Combing		21.9-0.9	-	-	-	-	-	-	-	50,000	-	230,000	2	-	140,000	140,000	230,000	50,000

Table 9
Fecal Coliform
(MPN per 100 ml)
Blackstone River
August 1964 Survey

	Station Number	River Mile	Tuesday 8-4	Wednesday 8-5	Thursday 8-6	Friday 8-7	Monday 8-10	Tuesday 8-11	Wednesday 8-12	Thursday 8-13	Friday 8-14	Monday 8-17	No. of Sampl.	Most Probable Number	Median	Average	Maximum	Minimum
Non-Intercepted Sewage	B-14	46.9	4,900	1,600,000	< 2,000	< 2,000	200	1,300	33,000	7,300	13,000	33,000	10	6,200	6,800	< 170,000	1,600,000	200
Worcester Sewage	B-13	46.0	1,600,000	< 20,000	130,000	< 2,000	9,200,000	1,700,000	3,300,000	1,090,000	3,430,000	1,780,000	10	1,500,000	1,690,000	< 2,224,000	9,200,000	< 2,000
Millbury Sewage	B-12	40.5	350,000	33,000	26,000	8,000	1,100,000	310,000	50,000	490,000	460,000	170,000	10	140,000	245,000	299,700	1,100,000	8,000
	B-112	38.9	-	-	-	-	-	790,000	130,000	460,000	23,000	172,000	5	190,000	172,000	315,000	790,000	23,000
Quinsigamond River Enters	B-11	36.8	23,000	33,000	49,000	7,000	5,000	49,000	49,000	170,000	70,000	5,000	10	26,500	41,000	46,000	170,000	5,000
Northbridge Sewage	B-10	31.3	790	3,100	4,100	4,600	1,100	2,200	7,000	49,000	24,000	1,700	10	3,400	3,600	9,760	49,000	790
	B-9	30.3	17,000	4,900	3,300	1,300	200	7,900	1,100	10,900	34,800	3,300	10	4,850	4,100	8,470	34,800	200
Mumford & West Rivers Enter	B-8A	27.7	-	-	-	-	< 2,000	1,700	700	7,000	4,600	500	6	1,850	1,700	< 2,750	7,000	500
	B-8	24.5	< 200	20	< 200	< 200	200	200	< 200	200	2,300	< 200	10	-	< 200	< 390	2,300	20
Millville Sewage Mass-R.I. State Line	B-7		1,300	3,500	98,000	98,000	200	200	700	3,300	500	200	10	1,030	1,000	12,390	98,000	200
Branch River Enters Blackstone Sewage R.I.-Mass. State Line	B-6	21.0	310	4,900	13,000	35,000	400	490	730	1,770	1,300	< 200	10	1,000	1,043	< 5,800	35,000	< 200
Blackstone Sewage Mass.-R.I. State Line	B-5	20.0	1,700	500	2,300	2,800	200	1,300	500	300	1,300	500	10	950	1,050	1,160	2,300	200
Non-Intercepted Woonsocket Sewage	B-4	17.2	49,000	280,000	170,000	33,000	23,000	23,000	17,100	14,000	13,000	33,000	10	24,000	28,000	59,500	280,000	13,000
Woonsocket Sewage	B-3	14.7	1,300,000	1,300,000	3,300,000	1,300,000	110,000	1,300,000	2,210,000	790,000	130,000	110,000	10	1,050,000	1,300,000	1,125,000	3,300,000	110,000
Manville & Albion Sewage	B-2	11.4	4,900	8,000	43,000	230,000	8,000	13,000	33,000	49,000	210,000	5,000	10	19,000	23,000	59,700	230,000	2,000
Ashton & Berkeley Sewage	B-1	6.9	3,300	3,300	13,000	28,000	2,000	2,000	4,000	11,000	17,000	5,000	10	4,300	4,500	8,860	28,000	2,000

Table [illegible]
Fecal Coliform
(MPN per 100 ml)
Blackstone River Tributaries
August 1964 Survey

	Station Number	River Mile	Tuesday 8-4	Wednesday 8-5	Thursday 8-6	Friday 8-7	Monday 8-10	Tuesday 8-11	Wednesday 8-12	Thursday 8-13	Friday 8-14	Monday 8-17	No. of Sampl.	Most Probable Number	Median	Average	Maximum	Minimum
Quinsigamond River		B-35.7																
	Q-1	1.0	280	3,300	280	500	-	-	-	-	-	-	4	-	510	1,140	3,300	280
Mumford River		B-29.5																
	M-4	10.8	-	< 20	20	30	-	-	-	-	-	-	3	-	20	< 40	[illegible]	< 20
Hayward (Stalnaker) Woolens Hayward Schuster Woolens																		
	M-3	5.6	-	< 200	< 200	50	-	-	-	-	-	-	3	-	< 200	< 150	< 200	50
Whitinsville & Linwood																		
	M-2	0.5	500	1,700	8,300	800	8,000	200	400	1,700	800	200	10	480	450	[illegible]	8,300	200
[illegible] Sewage																		
	M-1	0.4	130,000	170,000	70,000	110,000	79,000	79,000	49,000	23,000	79,000	49,000	10	75,000	79,000	83,600	170,000	23,000
West River		B-18.7																
	W-1	0.6	13,000	3,300	8,300	8,300	-	-	-	-	-	-	4	-	8,300	8,200	13,000	3,300
Branch River		B-21.9																
	BR-2	8.6	< 200	140	80	40	80	110	80	20	< 20	20	10	55	60	< 70	140	< 20
Stanton Mills Branch River Wool Combing																		
	BR-1	0.8	4,900	9,000	23,000	17,000	1,700	4,900	7,900	4,600	4,300	3,400	10	7,900	6,400	[illegible]	23,000	1,700
Major Discharges																		
Worcester Sewage		B-46.6	-	-	-	-	-	-	630,000	-	2,400,000	5,480,000	3	-	2,400,000	2,817,000	5,480,000	630,000
Branch River Wool Combing		B1.9-0.9	-	-	-	-	-	-	-	< 80,000	-	3,300	2	-	> 11,650	> 11,650	< 80,000	3,300

Table 11
Total Coliform
(MPN per 100 ml)
Ten Mile River & Tributary
August, 19[illegible] Survey

	Station Number	River Mile	Tuesday 8-4	Wednesday 8-5	Thursday 8-6	Friday 8-7	Monday 8-10	Tuesday 8-11	Wednesday 8-12	Thursday 8-13	Friday 8-14	Monday 8-17	No. of Sampl.	Most Probable Number	Median	Average	Maximum	Minimum
Ten Mile River	T-9	19.8	700	3,300	7,000	1,400	-	-	-	-	-	-	4	-	3,300	3,100	7,000	700
	T-8	16.8	1,700	7,900	22,000	15,000	350,000(1)	7,900	3,300	17,000	700	1,400	10	7,300	7,900	9,400	350,000	700
North Attleboro Sewage Treat. Plant																		
	T-7	15.6	140,000	49,000	79,000	11,000	23,000	13,000	490	4,900	3,300	2,300	10	12,000	12,000	30,000	140,000	490
	T-6A	11.6	-	-	-	-	700	330	460	490	3,300	170	6	460	475	910	3,300	170
	T-6	9.3	200	1,700	490	490	490	1,100	24,000(1)	230	1,300	940	10	730	715	770	24,000	200
	T-5A	8.2	-	-	-	-	22,000(1)	3,300	3,300	7,900	490	7,900	6	5,100	5,500	4,500	22,000	490
	T-5	8.0	>1,600,000	3,500,000	3,500,000	4,900,000	490,000	>16,000,000	92,000,000	3,300,000	34,800,000	3,300,000	10	4,930,000	3,400,000	>16,493,000	92,000,000	490,000
Attleboro Sewage Treatment Plant Mass.-Rhode Island State Line Seven Mile River enters																		
Rhode Island-Mass. State Line	T-4	7.4	>1,600,000	7,900,000	92,000,000	17,000,000	790,000	7,900,000	4,600,000	34,800,000	10,900,000	7,900,000	10	9,000,000	7,900,000	>18,570,000	92,000,000	790,000
Mass.-Rhode Island State Line	T-3	7.0	>1,600,000	7,900,000	92,000,000	13,000,000	1,300,000	13,000,000	3,300,000	7,900,000	7,000,000	4,600,000	10	6,900,000	7,450,000	>15,160,000	92,000,000	1,300,000
East Providence Waterworks Intake	T-2	2.5	300	460	2,400	4,900	1,700	24,000(1)	490	1,730	1,300	460	10	1,300	1,300	1,530	24,000	460
	T-1	0.8	33,000	27,000	49,000	33,000	-	-	-	-	-	-	4	-	33,000	35,000	49,000	17,000
Tributary																		
Seven Mile River	S-1	T-7.4 0.6	200	7,000	4,900	4,900	-	-	-	-	-	-	4	-	4,900	4,250	7,000	200
Major Discharges																		
Attleboro Sewage		7.8	-	-	-	-	-	13,000,000	-	10,900,000	4,900,000	-	3	-	10,900,000	9,600,000	13,000,000	4,900,000
North Attleboro Sewage		15.9	-	-	-	-	-	< 2,000	-	< 2,000		< 20	3	-	< 2,000	-	-	-

(1) Note: Not used in average.

Table 12
Fecal Coliform
(MPN per 100 ml)
Ten Mile River & Tributary
August [illegible] Survey

	Station Number	River Mile	Tuesday 8-4	Wednesday 8-5	Thursday 8-6	Friday 8-7	Monday 8-10	Tuesday 8-11	Wednesday 8-12	Thursday 8-13	Friday 8-14	Monday 8-17	No. of Sampl.	Most Probable Number	Median	Average	Maximum	Minimum
Ten Mile River																		
	T-9	13.4	200	< 200	20	< 20	-	-	-	-	-	-	4	-	< 110	< 110	200	< 20
	T-8	16.8	1,130	< 200	700	2,200	200	< 700	200	800	130	170	10	470	200	< 590	2,200	130
So. Attleboro Sewage	T-7	15.6	11,000	3,300	500	800	500	200	20	< 200	280	40	10	340	360	< 1,600	11,000	20
	T-6A	11.6	-	-	-	-	130	< 20	50	50	790	< 20	6	50	50	< 130	790	< 20
	T-6	9.3	< 200	230	50	50	80	50	230	20	1,300	80	10	100	95	< 230	1,300	20
	T-5A	8.2	-	-	-	-	< 20,000(1)	< 200	340	330	330	1,300	6	-	330	< 500	1,300	< 200
	T-5	8.0	920,000	170,000	1,300,000	170,000	50,000	7[illegible],000	13,000,000	330,000	4,900,000	330,000	10	510,000	515,000	2,187,000	13,000,000	50,000
Attleboro Sewage Treatment Plant																		
Mass.-Rhode Island State Line																		
Seven Mile River Enters																		
	T-4	7.4	>1,600,000	460,000	2,300,000	1,700,000	80,000	2,300,000	490,000	1,100,000	860,000	490,000	10	790,000	795,000	1,078,000	2,300,000	80,000
Rhode Island-Mass. State Line Mass.-R.I. State Line	T-3	7.0	>1,600,000	330,000	2,100,000	790,000	170,000	700,000	330,000	700,000	1,300,000	1,090,000	10	830,000	745,000	911,000	2,100,000	170,000
East Providence Water Works Intake	T-2	2.5	200	< 20	330	80	70	790	170	80	200	330	10	160	165	< 230	790	< 20
	T-1	0.8	4,900	1,700	13,000	900	-	-	-	-	-	-	4	-	3,300	5,030	13,000	900
Tributary																		
Seven Mile River		7.6																
	S-1	0.6	200	730	490	2,300	-	-	-	-	-	-	4	-	640	950	2,300	200
Major Discharges																		
Attleboro Sewage		7.8	-	-	-	-	-	3,300,000	-	2,210,000	-	790,000	3	-	2,210,000	2,100,000	3,300,000	790,000
So. Attleboro Sewage		15.9						< 2,000		< 2,000		< 20	3	-	< 2,000	< 1,340	< 2,000	< 20

Table 13
Coliform Bacteria Data Summary
Blackstone & Ten Mile Rivers

Sample Station	River Mile	No. of Samples	TOTAL COLIFORM BACTERIA Representative Conditions Most Probable	Median	Average	Maximum	Minimum	Percent Samples Exceeding 1,000 MPN	2,400 MPN	5,000 MPN	MEDIAN FECAL COLIFORM MPN/100 ml	% of Median Total Coliform	Sample Station
BLACKSTONE RIVER													
B-14	46.9	10	143,000	104,500	394,000	> 1,600,000	4,900	100	100	90	6,400	6.1	B-14
B-13	46.0	10	8,600,000	8,550,000	8,458,000	24,000,000	50,000	100	100	100	1,650,000	19.3	B-13
B-12	40.5	10	1,600,000	1,660,000	4,363,000	16,000,000	110,000	100	100	100	245,000	14.8	B-12
B-11C	38.9	5	1,200,000	1,300,000	4,050,000	16,000,000	220,000	100	100	100	172,000	13.2	B-11C
B-11	36.8	10	165,000	155,000	339,000	1,720,000	33,000	100	100	100	41,000	26.5	B-11
B-10	31.3	10	31,500	22,500	74,950	348,000	4,900	100	100	90	3,600	16.0	B-10
B-9	30.0	10	41,000	32,000	88,190	348,000	7,900	100	100	100	4,100	12.8	B-9
B-8A	27.7	6	92,000	112,000	157,200	540,000	22,100	100	100	100	1,700	1.5	B-8A
B-8	24.5	10	33,000	28,000	97,150	350,000	3,500	100	100	80	< 200	< 0.7	B-8
B-7	22.3	10	61,000	51,500	71,150	170,000	3,500	100	100	90	1,000	1.9	B-7
B-6	21.0	10	21,000	18,000	37,300	160,000	2,100	100	90	80	1,045	5.8	B-6
B-5	20.0	10	28,000	20,000	57,550	170,000	2,200	100	90	80	1,050	5.2	B-5
B-4	17.2	10	100,000	94,000	228,600	1,400,000	31,000	100	100	100	28,000	29.8	B-4
B-3	14.7	10	7,500,000	7,450,000	12,340,000	35,000,000	1,300,000	100	100	100	1,300,000	17.5	B-3
B-2	11.4	10	265,000	230,000	680,800	2,800,000	79,000	100	100	100	23,000	10.0	B-2
B-1	6.9	10	260,000	255,000	585,800	3,500,000	79,000	100	100	100	4,500	1.8	B-1
BLACKSTONE RIVER TRIBUTARIES													
Quinsigamond River													
Q-1	1.8	4	-	12,450	16,950	35,000	7,900	100	100	100	510	4.1	Q-1
Mumford River													
M-4	10.2	3	-	1,300	2,840	7,000	230	67	33	33	20	1.5	M-4
M-3	5.6	3	-	2,800	17,300	49,000	200	67	67	33	< 200	7.1	M-3
M-2	0.5	10	44,500	64,000	61,900	130,000	6,300	100	100	100	450	9.8	M-2
M-1	0.4	10	228,000	225,000	245,000	540,000	49,000	100	100	100	79,000	20.0	M-1
West River													
W-1	0.6	4	-	13,450	16,200	33,000	4,900	100	100	50	2,800	20.8	W-1
Branch River													
BR-2	2.6	10	1,950	1,700	2,050	3,300	1,300	100	30	0	60	3.5	BR-2
BR-1	0.8	10	56,000	49,000	68,600	172,000	13,000	100	100	100	6,400	13.1	BR-1
TEN MILE RIVER													
T-9	19.8	4	-	3,300	3,100	7,000	700	50	50	25	< 110	< 3.3	T-9
T-8	16.8	10	7,300	7,900	9,460	350,000	700	90	70	60	200	2.5	T-8
T-7	15.6	10	12,800	12,000	32,600	140,000	490	90	80	60	360	3.0	T-7
T-6A	11.6	6	480	475	910	3,300	170	17	17	0	50	10.5	T-6A
T-6	9.3	10	730	715	770	24,000	200	40	10	10	80	11.2	T-6
T-5A	8.2	6	5,100	5,500	4,580	20,000	490	83	83	50	330	6.0	T-5A
T-5	8.0	10	4,950,000	3,400,000	>16,893,000	92,000,000	230,000	100	100	100	515,000	15.1	T-5
T-4	7.4	10	9,000,000	7,900,000	>18,539,000	98,000,000	790,000	100	100	100	795,000	10.1	T-4
T-3	7.0	10	6,500,000	7,450,000	>15,160,000	92,000,000	1,300,000	100	100	100	745,000	10.0	T-3
T-2	2.5	10	1,300	1,500	1,530	24,000	460	60	20	10	185	12.3	T-2
T-1	0.8	4	-	33,000	33,000	49,000	17,000	100	100	100	3,300	10.0	T-1
TEN MILE TRIBUTARY													
Seven Mile River													
S-1	0.6	4	-	4,900	4,850	7,000	200	75	75	25	640	13.0	S-1
MAJOR DISCHARGES													
Worcester S.T.P. effluent		3	-	10,900,000	15,500,000	34,800,000	840,000	-	-	-	2,400,000	22.0	
Fr. B. Wool Comb. Pond effluent		2	-	140,000	140,000	250,000	50,000	-	-	-	> 11,650	> 8.0	
Attleboro S.T.P. effluent		3	-	10,900,000	9,600,000	13,000,000	4,900,000	-	-	-	2,210,000	20.0	
N. Attleboro S.T.P. effluent		3	-	< 2,000	< 1,300	< 2,000	< 20	-	-	-	< 2,000	-	

TABLE 14

NUMBER OF BOTTOM ORGANISMS PER SQUARE FOOT
MARCH 1964
BLACKSTONE RIVER
MASSACHUSETTS-RHODE ISLAND

	Massachusetts						Rhode Island				
Station (River Miles) →	49.6	46.1	40.5	36.8	26.0	23.7	21.7	16.5	15.0	10.3+	10.3-
						SENSITIVE ORGANISMS					
KINDS											
Stoneflies - Plecoptera											
Alloperla sp.	22	-	-	-	-	-	-	-	-	-	-
Brachyptera sp.	1	-	-	-	-	-	-	-	-	-	-
Isoperla sp.	4	-	-	-	-	-	-	-	-	-	-
Mayflies - Ephemeroptera											
Stenonema sp.	2	-	-	-	-	-	-	-	-	-	-
Ephemerella sp.	6	-	-	-	-	-	-	-	-	-	-
Fishflies - Megaloptera											
Chauliodes sp.	17	-	-	-	-	-	-	-	-	-	-
Caddisflies - Tricoptera											
Polycentropus sp.	56	-	-	-	-	-	-	-	-	-	-
Cheumatopsyche sp.	19	-	-	-	-	-	2	-	-	-	-
Micrasema sp.	16	-	-	-	-	-	-	-	-	-	-
Psychomyiidae sp.	7	-	-	-	-	-	-	-	-	-	-
Neophylax sp.	1	-	-	-	-	-	-	-	-	-	-
Leptoceridae sp.	1	-	-	-	-	-	-	-	-	-	-
Riffle Beetles - Elmidae	18	-	-	-	-	-	-	-	-	-	-
Subtotal Organisms	170	0	0	0	0	0	2	0	0	0	0
Subtotal Kinds	13	0	0	0	0	0	1	0	0	0	0
						INTERMEDIATE ORGANISMS					
Water Scavenger Beetles - Hydrophilidae											
Berosus sp.	-	-	-	-	-	1	-	-	-	-	-
Black Flies - Simuliidae	336	-	-	-	-	-	-	-	-	-	-
Midges - Tendipedidae[1]	140	-	-	-	1	-	22	-	-	-	-
Crane Flies - Tipulidae											
Antocha sp.	9	-	-	-	-	-	-	-	-	-	-
Tipula sp.	3	-	-	-	-	-	-	-	-	-	-
Roundworms - Nematoda	-	-	-	-	-	-	2	-	-	-	-
Scuds - Amphipoda											
Hyalella sp.	121	-	-	-	-	-	9	-	-	-	-
Fingernail Clams - Pelecypoda	16	-	-	-	-	-	-	-	-	-	-
Snails - Gastropoda											
Physa sp.	-	-	-	-	-	-	2	-	-	-	-
Limpets - Gastropoda											
Ferrissia sp.	-	-	-	-	-	-	1	-	-	-	-
Unidentified	1	-	-	-	-	-	-	-	-	-	-
Subtotal Organisms	626	0	0	0	1	1	36	0	7	0	0
Subtotal Kinds	7	0	0	0	1	1	5	0	1	0	0
						TOLERANT ORGANISMS					
Leeches - Hirudinea	-	-	-		10	3	39	-	-	-	-
Sludgeworms - Tubificidae	-	6,972	16,800	19,488	562	2,522	6	2,836	3	385	1,176
Bloodworms - Tendipedidae[2]	-	-	-	-	9	1	1	-	-	17	-
Subtotal Organisms	0	6,972	16,800	19,488	581	2,526	46	2,836	3	403	1,176
Subtotal Kinds	0	1	1	1	3	3	3	1	1	3	1
Grand Total Organisms	796	6,972	16,800	19,488	582	2,527	84	2,836	10	403	1,176
Grand Total Kinds	20	1	1	1	4	4	9	1	2	3	1

1 - Tendipedidae larvae without ventral blood gills.

2 - Tendipedidae larvae with ventral blood gills.

TABLE 15

NUMBER OF BOTTOM ORGANISMS PER SQUARE FOOT
BLACKSTONE RIVER
AUGUST, 1964
MASSACHUSETTS - RHODE ISLAND

	Massachusetts								State Line Area		Rhode Island			
Station (River Miles) ⟶	47.9	46.1	40.5	36.8	34.1	29.9	27.7	23.7	22.0	21.7	20.0	14.6	11.3	7.9
KINDS														
NO SENSITIVE ORGANISMS														
INTERMEDIATE ORGANISMS														
Midges - Tendipedidae[1]	-	-	-	134	6	1.792	213	179	50	318	2	3,792	947	736
Black Flies - Simulidae	-	-	-	2	2	23	3	1	-	38	-	768	3	32
Phantom Midges - Culicidae														
Chaoborus sp.	-	-	-	-	-	-	-	-	-	-	11	-	-	-
Crane Flies - Tipulidae														
Antocha sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tipula sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roundworms - Nematoda	-	-	-	-	-	-	19	2	3	26	-	14	107	4
Flatworms - Turbellaria	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Scuds - Amphipoda														
Hyalella sp.	-	-	-	-	2	-	-	-	-	-	-	3	-	38
Sowbugs - Isopoda														
Asellus sp.	-	-	-	-	-	-	-	-	-	-	-	-	4	5
Fingernail Clams - Pelecypoda														
Sphaeridae	-	-	-	-	-	-	5	-	-	-	-	-	-	-
Snails - Gastropoda	-	-	-	-	3	3	3	4	3	6	-	4	3	2
Limpets - Gastropoda	-	-	-	-	-	-	-	-	-	-	-	-	40	9
Subtotal Organisms	0	0	0	136	13	1.818	243	186	56	388	13	4.581	1.104	827
Subtotal Kinds	0	0	0	2	4	3	5	4	3	4	2	5	6	8
TOLERANT ORGANISMS														
Leeches - Hirudinea	-	-	-	-	85	50	74	27	26	6	-	48	59	51
Midges - Tendipedidae[2]	-	-	-	-	205	-	277	44	-	-	-	464	122	166
Sludgeworms - Tubificidae	20,352	3,645	55,808	4,454	3,731	1,805	187	3,193	6	70	-	23.040	230	1 178
Subtotal Organisms	20,352	3,645	55,808	4,454	4,021	1.855	538	3,264	32	76	0	23.552	411	1 395
Subtotal Kinds	1	1	1	1	3	2	3	3	2	2	0	3	3	3
Grand Total Organisms	20,352	3,645	55,808	4,590	4,034	3,673	781	3,450	88	464	13	28.133	1.515	2 222
Grand Total Kinds	1	1	1	3	7	5	8	7	5	6	2	8	9	11

1 - Tendipedidae larvae without ventral blood gills.

2 - Tendipedidae larvae with ventral blood gills.

TABLE 16

NUMBER OF BOTTOM ORGANISMS PER SQUARE FOOT
MARCH 1964
TRIBUTARY STREAMS TO THE BLACKSTONE RIVER
MASSACHUSETTS-RHODE ISLAND

	MUMFORD RIVER			WEST RIVER	CHEPACHET R.	BRANCH RIVER		
Station (River Miles) →	29-11.6	29-7.4	29-1.2	28-0.6	22-10.0	22-6.0	22-2.6	22-0.8
				SENSITIVE ORGANISMS				
KINDS								
Stoneflies - Plecoptera								
Acroneuria sp.	-	-	-	-	3	-	-	-
Isoperla sp.	5	-	-	-	2	-	-	-
Alloperla sp.	2	-	-	-	-	-	-	-
Brachyptera sp.	2	-	-	-	-	-	-	-
Mayflies - Ephemeroptera								
Stenonema sp.	11	-	-	-	15	-	-	-
Ephemerella sp.	-	-	-	-	10	-	-	-
Fishflies - Megaloptera								
Chauliodes sp.	3	-	-	-	2	-	-	-
Alderflies - Megaloptera								
Sialis sp.	-	-	-	-	3	-	-	-
Caddisflies - Tricoptera								
Cheumatopsyche sp.	23	-	37	-	3	29	1	-
Hydropsyche sp.	20	-	-	-	2	-	1	-
Chimarra sp.	14	-	-	-	-	-	-	-
Polycentropus sp.	-	-	-	-	11	-	-	-
Ptilostomis sp.	-	-	-	-	3	-	-	-
Rhyacophila sp.	5	-	-	-	-	-	-	-
Glossosoma sp.	1	-	-	-	-	-	-	-
Unidentified sp.	-	-	-	-	3	-	-	-
Water Penny - Psephenidae								
Psephenus sp.	2	-	-	-	3	-	-	-
Dryopids - Dryopidae								
Helichus sp.	-	-	-	2	1	-	-	-
Subtotal Organisms	88	0	37	2	61	29	1	0
Subtotal Kinds	11	0	1	1	13	1	1	0
				INTERMEDIATE ORGANISMS				
Black Flies - Simuliidae	199	-	-	-	-	59	2	-
Midges - Tendipedidae[1]	3	-	30	111	22	7	1	-
Snipe Flies - Rhagionidae								
Atherix sp.	-	-	-	-	3	-	-	-
Crane Flies - Tipulidae								
Antocha sp.	1	-	-	-	-	-	-	-
Damselflies - Zygoptera								
Agrion sp.	-	-	-	-	1	-	-	-
Planaria - Turbellaria	-	-	-	2	-	7	-	-
Scuds - Amphipoda								
Hyalella sp.	-	-	-	-	3	28	-	-
Sowbugs - Isopoda								
Asellus sp.	-	-	2	2	-	2	2	-
Crawfish - Decapoda	-	-	-	-	-	1	-	-
Fingernail Clams - Pelecypoda	1	-	-	17	1	-	-	-
Operculate Snails - Gastropoda	-	-	-	2	-	-	-	-
Limpets - Gastropoda								
Ferrissia sp.	-	-	-	7	-	1	-	-
Subtotal Organisms	204	0	32	141	30	105	5	0
Subtotal Kinds	4	0	2	6	5	7	3	0
				TOLERANT ORGANISMS				
Leeches - Hirudinea	-	-	-	18	-	7	-	-
Bloodworms - Tendipedidae[2]	-	-	-	44	-	-	-	-
Sludgeworms - Tubificidae	-	-	5	20	-	5	1	15
Subtotal Organisms	0	0	5	82	0	12	1	15
Subtotal Kinds	0	0	1	3	0	2	1	1
Grand Total Organisms	292	0	74	225	91	146	7	15
Grand Total Kinds	15	0	4	10	18	10	5	1

1 - Tendipedidae larvae without ventral blood gills.

2 - Tendipedidae larvae with ventral blood gills.

TABLE 17

NUMBER OF ORGANISMS PER SQUARE FOOT
TRIBUTARIES TO THE BLACKSTONE RIVER

AUGUST, 1964

MASSACHUSETTS - RHODE ISLAND

	RHODE ISLAND					MASSACHUSETTS					
	CHEPACHET R.	BRANCH R.				WEST R.	MUMFORD R.				
Station (River Miles) ——>	22-10.0	22-6.0	22-2.6	22-1.1	22-0.8	26-0.6	29-10.2	29-7.8	29-7.4	29-1.2	29-0.4
	SENSITIVE ORGANISMS										
KINDS											
Stoneflies - Plecoptera											
Brachyptera sp.	-	-	-	-	-	-	1	-	-	-	-
Mayflies - Ephemeroptera											
Caenis sp.	2	-	-	-	-	-	-	-	-	-	-
Stenonema sp.	-	-	4	-	-	-	33	-	-	-	-
Tricorythodes sp.	-	-	1	-	-	-	-	-	-	-	-
Ameletus sp.	2	25	-	-	-	-	1	-	-	-	-
Heptagenia sp.	2	-	-	-	-	-	-	-	-	-	-
Alder - and Fishflies - Megaloptera											
Sialis sp.	-	-	-	-	-	-	-	-	-	-	-
Corydalus sp.	-	-	-	-	-	-	2	-	-	-	-
Caddisflies - Trichoptera											
Cheumatopsyche sp.	-	666	44	-	-	-	32	-	-	5	14
Hydropsyche sp.	-	18	12	-	-	-	40	-	-	-	-
Polycentropus sp.	19	-	-	-	-	-	-	-	-	-	-
Leucotrichia sp.	-	-	5	-	-	-	-	-	-	-	-
Water Pennies - Psephenidae											
Psephenus sp.	6	-	-	-	-	-	-	-	-	-	-
Riffle Beetles - Coleoptera											
Elmidae	3	-	1	-	-	-	32	-	-	-	-
Subtotal Organisms	34	709	67	0	0	0	141	0	0	5	14
Subtotal Kinds	6	3	6	0	0	0	7	0	0	1	1
	INTERMEDIATE ORGANISMS										
Scavenger Beetles - Hydrophilidae											
Berosus sp.	-	-	-	-	-	-	-	-	-	2	13
Midges - Tendipedidae[1]	107	3,590	440	29	2	144	75	602	-	458	89
Biting Midges - Ceratopogonidae											
Palpomyia sp.	2	-	-	-	-	-	-	-	-	-	-
Blackflies - Simuliidae	3	100	6	6	-	-	1	-	-	2	2
Craneflies - Tipulidae											
Antocha sp.	2	-	-	-	-	-	3	-	-	-	-
Roundworms - Nematoda	2	4	-	6	-	16	-	58	-	26	12
Flatworms - Turbellaria	2	428	9	-	-	-	9	-	-	-	-
Scuds - Amphipoda											
Hyalella sp.	-	-	2	-	-	-	-	-	-	-	-
Sowbugs - Isopoda											
Asellus sp.	-	-	67	-	-	-	1	6	-	16	-
Crayfish - Decapoda	-	-	-	-	-	-	-	-	-	-	-
Fingernail Clams - Pelecypoda											
Sphaeriidae	-	42	49	-	-	3	-	-	-	-	262
Mussels - Unionidae	-	-	-	-	-	-	-	-	-	-	-
Snails - Gastropoda	-	-	21	3	-	3	31	-	-	2	538
Limpets - Gastropoda	29	-	-	-	-	-	-	5	-	-	307
Dance Flies - Empididae	-	28	4	-	-	-	-	-	-	-	-
Subtotal Organisms	147	4,192	598	44	2	166	120	671	0	506	1,223
Subtotal Kinds	7	6	8	4	1	4	6	4	0	6	7
	TOLERANT ORGANISMS										
Leeches - Hirudinea	-	25	15	-	-	13	-	8	-	24	32
Midges - Tendipedidae[2]	-	-	8	-	-	-	-	-	-	13	45
Sludgeworms - Tubificidae	-	4	5	138	8	122	-	128	13	155	154
Subtotal Organisms	0	29	28	138	8	135	0	136	13	192	231
Subtotal Kinds	0	2	3	1	1	2	0	2	1	3	3
Grand Total Organisms	181	4,930	693	182	10	301	261	807	13	703	1,468
Grand Total Kinds	13	11	17	5	2	6	13	6	1	10	11

1 - Tendipedidae larvae without ventral blood gills.

2 - Tendipedidae larvae with ventral blood gills.

TABLE 18

NUMBER OF BOTTOM ORGANISMS PER SQUARE FOOT
MARCH 1964
Ten Mile RIVER
MASSACHUSETTS-RHODE ISLAND

Station(River Miles) →	19.6	18.5	16.8	15.6	13.1	11.6	9.2	8.1	8.0	7.7	7.0	5.8	2.2	0.8+
	Massachusetts										Rhode Island			
KINDS														
SENSITIVE ORGANISMS														
Alderflies - Megaloptera *Sialis* sp.	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Caddisflies - Tricoptera *Cheumatopsyche* sp.	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal Organisms	2	0	2	0	0	0	0	0	0	0	0	0	0	0
Subtotal Kinds	1	0	1	0	0	0	0	0	0	0	0	0	0	0
INTERMEDIATE ORGANISMS														
Midges - Tendipedidae[1]	13	2	101	-	-	-	487	-	4	-	-	25	336	-
Biting Midges - Ceratopogonidae *Palpomyia* sp.	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Roundworms - Nematoda	5	-	-	-	-	3	-	-	-	-	-	22	7	-
Scuds - Amphipoda *Hyalella* sp.	-	-	-	-	-	-	-	-	-	-	-	-	7	62
Sowbugs - Isopoda *Asellus* sp.	-	-	-	-	-	-	-	-	-	-	-	-	8	3
Fingernail Clams - Pelecypoda	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Snail - Gastropoda *Physa* sp.	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Planaria - Turbellaria	-	-	-	-	-	-	-	-	-	-	-	-	108	-
Subtotal Organisms	18	2	103	0	0	3	487	0	4	0	0	47	470	65
Subtotal Kinds	2	1	2	0	0	1	1	-	1	0	0	2	7	2
TOLERANT ORGANISMS														
Leeches - Hirudinea	-	-	-	-	-	-	-	-	-	-	-	27	12	-
Midges - Tendipedidae[2]	-	-	7	108	2	-	706	328	8	192	2	2	101	-
Rat-tailed Maggots - Syrphidae *Tubifera* sp.	-	-	-	-	-	-	-	-	-	4	-	-	-	-
Sludgeworms - Tubificidae	81	-	2	9,408	420	3	-	460	24	1,680	462	-	175	2
Subtotal Organisms	81	0	9	9,516	422	3	706	788	32	1,876	464	29	288	2
Subtotal Kinds	1	0	2	2	2	1	1	2	2	3	2	2	2	1
Grand Total Organisms	101	2	114	9,516	422	6	1,193	788	36	1,876	464	76	758	67
Grand Total Kinds	4	1	5	2	2	2	2	2	3	3	2	4	9	3

1 - Tendipedidae larvae without ventral blood gills.

2- Tendipedidae larvae with ventral blood gills.

TABLE 19

NUMBER OF BOTTOM ORGANISMS PER SQUARE FOOT

TEN MILE RIVER

AUGUST, 1964

MASSACHUSETTS - RHODE ISLAND

	Massachusetts								State Line Area		Rhode Island	
Station (River Miles) ——→	19.8	16.8	15.6	13.1	9.2	8.1	8.0	7.7	7.15	7.0	5.8	2.2
KINDS						SENSITIVE ORGANISMS						
Alderflies - Megaloptera												
Chauliodes sp.	-	6	-	-	-	-	-	-	-	-	-	-
Caddisflies - Trichoptera												
Cheumatopsyche sp.	38	-	-	-	-	-	-	-	-	-	-	-
Trentonius sp.	6	-	-	-	-	-	-	-	-	-	-	-
Riffle Beetles - Coleoptera												
Elmidae	13	-	-	-	-	-	-	-	-	-	-	-
Subtotal Organisms	57	6	0	0	0	0	0	0	0	0	0	0
Subtotal Kinds	3	1	0	0	0	0	0	0	0	0	0	0
						INTERMEDIATE ORGANISMS						
Scavenger Beetles - Hydrophilidae												
Berosus sp.	6	-	-	-	-	-	-	-	-	-	-	-
Midges - Tendipedidae[1]	1,073	90	1,382	90	154	538	51	38	-	258	4,265	2,099
Biting Midges - Ceratopogonidae												
Palpomyia sp.	-	38	-	-	6	-	-	-	-	-	-	-
Damselflies - Zygoptera												
Agrion sp.	-	-	-	-	12	-	-	-	-	-	-	-
Blackflies - Simuliidae	32	-	-	-	-	-	-	-	-	-	26	22
Roundworms - Nematoda	-	-	-	-	19	128	26	-	6	-	154	18
Flatworms - Turbellaria	7	-	-	-	-	-	-	-	-	-	-	19
Scuds - Amphipoda												
Hyalella sp.	-	-	-	-	-	-	-	-	-	-	-	1,024
Sowbugs - Isopoda												
Asellus sp.	-	-	-	3	13	-	-	-	-	-	-	17
Fingernail Clams - Pelecypoda												
Sphaeridae	32	-	-	-	-	-	-	-	-	-	-	5
Snails - Gastropoda	6	-	-	-	-	-	-	-	-	-	-	4
Subtotal Organisms	1,156	128	1 382	93	204	666	77	38	6	258	4,445	3,208
Subtotal Kinds	6	2	1	2	5	2	2	1	1	1	3	8
						TOLERANT ORGANISMS						
Leeches - Hirudinea	-	-	-	-	-	-	-	-	-	-	128	51
Midges - Tendipedidae[2]	6	-	11,059	22	6	1,433	51	-	256	307	154	205
Sludgeworms - Tubificidae	499	-	11,016	140	19	1,741	3,405	64	614	8,243	51	8,653
Subtotal Organisms	505	0	22,075	162	25	3,174	3,456	64	870	8,550	333	8,909
Subtotal Kinds	2	0	2	2	2	2	2	1	2	2	3	2
Grand Total Organisms	1,718	134	23,457	255	229	3,840	3,533	102	876	8,808	4,778	12,117
Grand Total Kinds	11	3	3	4	7	4	4	2	3	3	6	11

1 - Tendipedidae larvae without ventral blood gills.

2 - Tendipedidae larvae with ventral blood gills.

Table [illegible]
Biochemical Oxygen Demand (2 & 5 Days)
(Values in mg/l)
Blackstone River
August, [illegible] Survey

	Station Number	River Mile	Tuesday 8-4		Wednesday 8-5		Thursday 8-6		Friday 8-7		Monday 8-10		Tuesday 8-11		Wednesday 8-12		Thursday 8-13		Friday 8-14		Monday 8-17		No. of Samples		Average		Maximum		Minimum	
			2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day
Non-intercepted sewage & indus. waste																														
	B-14	46.9	-	13.4	-	4.8	3.1	6.4	-	3.3	-	5.6	-	-	-	6.5	-	-	-	5.5	-	-	1	7	3.1	6.5	3.1	13.4	3.1	3.3
Worcester sewage treatment pl. effluent																														
	B-13	46.0	>6.4	27.4	14.6	28.4	10.6	19.4	9.7	16.8	20.6	40.8	-	-	18.6	36.5	-	-	8.0	18.6	-	-	7	7	>12.6	26.0	20.6	40.8	>6.4	16.8
Felters Co., Millbury sewers, & Saider Packing																														
	B-12	40.5	-	10.2	-	3.6	1.1	5.9	-	3.0	-	20.8	-	-	-	4.5	-	-	-	10.1	-	-	1	7	1.1	8.3	1.1	20.8	1.1	3.0
J. J. O'Donnel																														
	B-11C	38.9	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6	-	-	-	6.8	-	-	0	2	-	6.2	-	6.8	-	5.6
Quinsigamond River enters																														
	B-11	36.8	3.0	9.5	-	12.6	3.6	9.3	8.4	6.8	8.8	7.8	-	-	3.7	9.8	10.2	15.1	3.6	8.7	-	-	7	8	4.2	10.0	10.2	15.1	8.4	6.8
Rayfer Co. enters Northbridge sewage treatment plant effluent																														
	B-10	31.3	-	10.2	-	7.3	3.1	7.3	-	5.2	-	4.2	-	-	-	4.0	-	-	-	6.1	-	-	1	7	3.1	6.3	3.1	10.2	3.1	4.0
Stanley Woolen Co.																														
	B-9	30.0	10.3	19.6	4.2	10.1	5.8	11.4	7.2	12.4	4.3	7.8	-	-	11.2	17.0	-	-	3.0	9.3	-	-	7	7	6.6	12.5	11.2	19.6	3.0	7.8
Mumford & West rivers enter																														
	B-8A	27.7	-	-	-	-	-	-	-	-	-	4.3	-	-	-	5.8	-	-	-	6.8	-	-	0	3	-	5.6	-	6.8	-	4.3
	B-8	24.5	-	2.8	-	3.2	1.7	3.7	-	2.6	-	2.3	-	-	-	2.2	-	-	-	-	-	-	1	6	1.7	2.8	1.7	3.7	1.7	2.2
Blackstone Wool & Millville sewage Mass.-Rhode Island State line																														
	B-7	22.3	1.4	3.8	1.4	3.2	2.4	4.7	1.5	3.6	1.0	2.7	0.5	1.6	0.7	2.0	1.8	3.1	1.1	5.1	0.9	2.5	10	10	1.3	3.4	2.4	5.1	0.5	1.6
Branch River enters & Blackstone sewage Rhode Island-Mass. State line																														
	B-6	21.0	-	13.2	-	11.1	6.4	17.7	-	20.4	-	5.5	-	10.0	-	15.9	-	12.1	-	6.1	-	6.0	1	10	6.4	11.8	6.4	17.7	6.4	5.5
Blackstone Sewage & industrial waste Mass.-Rhode Island State line																														
	B-5	20.0	-	15.9	-	>16.1	-	16.0	-	10.6	-	5.8	-	4.4	-	11.8	-	13.2	-	7.5	-	4.5	0	10	-	>10.6	-	16.0	-	4.4
Non-intercepted Woonsocket sewage and industrial waste																														
	B-4	17.2	-	20.2	-	13.3	5.9	9.7	-	8.6	-	10.0	-	-	-	6.4	-	-	-	7.5	-	-	1	7	5.9	11.1	5.9	20.2	5.9	6.4
Woonsocket sewage & industrial waste																														
	B-3	14.7	6.8	12.9	13.5	20.7	9.6	18.2	-	-	4.3	13.5	-	-	3.6	13.4	-	-	2.2	7.7	-	-	6	6	6.7	14.7	13.5	20.7	2.2	7.7
Manville sewage & industrial waste																														
	B-2	11.4	-	5.8	-	5.8	5.1	12.1	-	8.7	-	>16.8	-	-	-	-	-	-	-	-	-	-	1	5	5.1	>9.7	5.1	12.1	5.1	5.8
Ashton & Berkeley sewers																														
	B-1	6.9	-	4.4	-	4.9	3.6	9.5	-	9.4	-	>16.8	-	-	-	-	-	-	-	-	-	-	1	5	3.6	>9.0	3.6	9.5	3.6	4.4

Table XI
Biochemical Oxygen Demand (2 & 5 Day)
(Values in mg/l)
Blackstone River Tributaries
August, 1964 Survey

	Station Number	River Mile	Tuesday 8-4		Wednesday 8-5		Thursday 8-6		Friday 8-7		Monday 8-10		Tuesday 8-11		Wednesday 8-12		Thursday 8-13		Friday 8-14		Monday 8-17		No. of Samples		Average		Maximum		Minimum	
			2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day
Quinsigamond River		B-39.7																												
	Q-1	1.8	-	4.1	-	4.8	2.5	5.3	-	6.5	-	-	-	-	-	-	-	-	-	-	-	-	1	4	.5	5.2	2.5	6.5	2.5	4.1
Mumford River		B-29.5																												
	M-4	10.2	-	-	-	0.2	0.7	1.4	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0.7	0.9	0.7	1.4	0.7	0.2
Hayward (Risinger) Woolens Hayward Schuster Woolens																														
	M-3	5.6	-	-	-	13.1	5.1	8.1	-	9.4	-	-	-	-	-	-	-	-	-	-	-	-	1	3	5.1	10.2	5.1	13.1	5.1	8.1
Whitinsville & Linwood																														
	M-2	0.5	-	4.7	-	3.8	2.8	5.0	-	4.4	-	5.6	-	-	-	-	-	-	-	-	-	-	1	5	2.8	4.7	2.8	5.6	2.8	3.8
Emile Bernat																														
	M-1	0.4	7.4	13.0	7.4	15.6	9.2	16.4	6.4	12.2	4.1	8.8	-	-	6.0	9.7	-	-	1.2	7.4	-	-	7	7	6.0	11.9	9.2	16.4	1.2	7.4
West River		B-28.7																												
Wuscutuk Woolen Mill																														
	W-1	0.6	-	9.0	-	10.9	-	1.2	-	2.4	-	-	-	-	-	-	-	-	-	-	-	-	0	4	-	5.9	-	10.9	-	1.2
Branch River		B-21.9																												
	BR-2	2.6	-	3.4	-	3.0	1.7	3.1	-	3.1	-	3.4	-	3.3	-	-	-	3.6	-	3.5	-	5.0	1	9	1.7	3.5	1.7	5.0	1.7	3.0
Stanton Mills Branch River Wool Combing																														
	BR-1	0.8	38.9	88.6	34.6	78.2	39.9	86.0	-	-	38.8	57.2	-	42.4	14.8	188.8	44.0	60.8	3.6	13.6	127.5	240.4	8	9	42.8	88.4	127.5	240.4	3.6	13.6
Major Discharges																														
Branch River Wool Combing Co.		21.9-0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,825	4,075	-	-	-	10,275	1	2	1,825	7,185	1,825	10,275	1,825	4,075
Worcester Sewage Treatment Plant		46.6	-	-	-	-	-	-	-	-	-	-	-	-	-	36.6	-	-	-	69.9	-	59.5	0	3	-	53.0	-	69.9	-	36.6

Table 22
Biochemical Oxygen Demand (2 & 5 Day)
(Values in mg/l)
Ten Mile River
August, 1965 Survey

	Station Number	River Mile	Tuesday 8-4		Wednesday 8-5		Thursday 8-6		Friday 8-7		Monday 8-10		Tuesday 8-11		Wednesday 8-12		Thursday 8-13		Friday 8-14		Monday 8-17		No. of Samples		Average		Maximum		Minimum	
			2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-day	2-day	5-d
Whiting Pond																														
	T-9	19.8	-	6.5	-	5.0	7.3	>8.5	-	4.2	-	-	-	>8.6	-	-	-	-	-	-	-	-	1	5	7.3	>6.6	7.3	6.5	7.3	4.
	T-8	16.8	-	2.8	-	3.7	2.2	4.2	-	3.2	-	-	-	7.0	-	-	-	5.0	-	-	-	4.1	1	7	2.2	4.5	2.2	7.0	2.2	2.
N. Attleboro Sewage Treatment Plant																														
	T-7	15.6	-	9.5	-	10.6	4.6	9.5	-	7.4	-	-	-	7.1	-	-	-	6.9	-	-	-	5.3	1	7	4.6	8.1	4.6	10.6	4.6	5.
	T-6A	11.6	-	-	-	-	-	-	-	-	-	-	-	10.9	-	-	-	10.6	-	-	-	-	0	2	-	10.8	-	10.9	-	10.
Dodgeville Finishing Co.																														
	T-6	9.3	-	9.2	-	13.9	7.5	13.3	-	10.8	-	-	-	13.4	-	-	-	11.6	-	-	-	10.8	1	7	7.5	10.4	7.5	13.9	7.5	9.
Thompson Chemical Co.																														
	T-5A	8.2	-	-	-	-	-	-	-	-	-	46.2	-	14.3	-	22.6	-	23.9	-	19.4	-	18.7	0	6	-	25.2	-	46.2	-	14.
Attleboro Dyeing & Finishing																														
Attleboro STP;Mass.-R.I.State Line; Seven Mile River Enters	T-5	8.0	-	45.6	-	46.6	-	23.8	-	29.2	-	18.0	-	36.2	-	33.8	-	28.4	-	28.8	-	19.5	0	10	-	31.9	-	33.8	-	16.
Rhode Island-Mass. State Line Pawtucket Dyeing & Bleaching	T-4	7.4	-	>50.0	-	17.9	-	22.4	-	18.6	-	22.9	-	22.4	-	22.4	-	22.8	-	-	-	18.2	0	9	-	>21.7	-	22.9	-	17.
Mass.-Rhode Island State Line	T-3	7.0	-	>50.0	-	11.3	-	20.1	-	21.9	-	-	-	31.8	-	16.4	-	21.4	-	15.2	-	22.2	0	9	-	>22.1	-	31.8	-	11.
	T-2	2.5	5.2	7.2	-	6.9	5.2	7.9	-	6.1	-	-	-	5.8	-	-	-	7.6	-	-	-	8.1	2	7	4.2	7.1	5.2	8.1	3.2	5.
	T-1	0.8	-	>7.8	-	>7.8	4.0	7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	4.0	>7.7	4.0	8.2	4.0	7.
Tributary																														
Seven Mile River	S-1	7.6 7.6-0.6	-	1.6	-	5.5	2.0	3.1	-	2.2	-	-	-	-	-	-	-	-	-	-	-	-	1	4	2.0	3.1	2.0	5.5	2.0	1.
Major Discharges & Special Samples																														
	T-5A Filtered		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.8	-	-	-	9.2	0	2	-	11.0	-	12.8	-	9.
Attleboro Sewage Treatment Plant		7.8	-	-	-	-	-	-	-	-	-	-	-	46.0	-	-	-	54.0	-	-	-	70.6	0	3	-	56.9	-	70.6	-	46.
So. Attleboro Sewage Treatment Plant		15.9	-	-	-	-	-	-	-	-	-	-	-	3.0*	-	-	-	*	-	-	-	*	0	3	-	*	-	*	-	

*Note: Too much chlorine in waste for test to be accurate.

Table 23
Dissolved Oxygen
(in mg/l)
Blackstone River
Aug. 1964 Survey

	Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17	Avg.	Max.	Min.	% less than 5.0
Non-intercepted sewer & indus. waste																
	B-14	46.9	2.2	0.0	1.6	1.4	5.6	1.4	2.8	5.9	5.0	4.6	3.0	5.9	0.0	70
Worcester Sewage Treatment Pl. effl.																
	B-13	46.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	2.3	1.0	0.2	0.4	2.3	0.0	100
Felters Co., Millbury sewers, & Snider Packing, dams & rapids																
	B-12	40.5	7.4	3.9	5.6	4.2	6.2	4.9	2.6	6.5	5.7	6.4	5.4	7.4	2.6	40
Quinsigamond River enters																
	B-11E	39.7	-	-	-	-	7.5	1.8	6.2	3.0	4.2	5.8	4.8	7.5	1.8	50
Dam at Fisherville																
	B-11D	39.5	-	-	-	-	7.4	6.7	6.5	6.7	4.2	5.2	6.1	7.4	4.2	17
Pool																
	B-11C	39.0	-	-	-	-	7.4	1.7	6.5	3.2	.9	0.9	3.6	7.4	0.9	67
Dam at Farnumsville																
	B-11B	38.8	-	-	-	-	7.4	4.8	6.4	4.8	2.0	1.9	4.6	7.4	1.9	67
J. J. O'Donnell wastes (Farnumsville)																
	B-11A	36.9	4.0	4.6	2.2	3.4	5.0	2.0	1.1	2.8	2.0	1.4	2.8	5.0	1.1	90
Dam at Northbridge																
	B-11	36.8	7.1	7.2	6.4	5.0	7.4	6.4	5.8	6.3	6.7	6.5	6.5	7.4	5.0	0
	B-10C	35.0+	-	-	-	-	2.2	4.4	1.3	5.2	4.4	2.1	3.3	5.2	1.3	83
Dam & Kupfer Co. (Riverdale)																
	B-10B	35.0-	-	-	-	-	1.3	4.3	2.2	5.0	5.0	3.3	3.5	5.0	1.3	67
	B-10A	34.1	-	-	-	-	2.4	1.6	1.0	4.2	4.0	2.7	2.6	4.2	1.0	100
Northbridge Sewage Treatment Pl. effl.																
	B-10	31.3	4.9	3.5	5.4	0.9	1.2	0.5	0.8	3.2	0.6	1.1	2.2	5.4	0.5	90
Dam forming Rice City pond Stanley Woolen Co.																
	B-9	29.9+	7.9	7.4	8.2	6.0	7.3	5.7	6.5	5.8	4.1	6.5	6.5	8.2	4.1	10
Mumford & West rivers enter																
	B-8A	27.7	-	-	-	-	2.6	2.6	1.4	3.2	2.2	2.9	2.5	3.2	1.4	100
	B-8	24.5	2.3	5.8	5.2	3.3	5.5	3.2	1.6	2.8	1.6	3.4	3.5	5.8	1.6	70
Blackstone Wool & Millville Sew.																
	B-7A	22.4	7.6	9.2	7.1	5.4	-	3.2	2.2	2.0	1.0	4.11	4.6	9.2	1.0	18
Dam above State line																
Massachusetts-Rhode Island State line	B-7	22.3	8.3	10.2	8.8	7.9	8.1	8.0	6.8	7.1	6.7	7.6	8.0	10.2	6.7	0
Branch River enters + Blackstone sew. (Rhode Island-Mass. State line)																
	B-6	21.0	3.6	3.6	3.9	3.3	5.6	3.6	2.3	2.7	5.3	5.0	3.9	5.6	2.3	70
Blackstone Sew. & Indus. Waste (Mass.-Rhode Island State line)																
	B-5	20.0	3.7	2.3	2.4	4.2	6.4	3.7	3.0	2.0	5.2	4.9	3.8	6.4	2.0	80
Non-intercepted Woonsocket sew. & ind. waste (+ dams, pools & rapids)																
	B-4	17.2	9.2	8.3	7.2	9.2	10.3	8.1	8.0	8.0	8.6	8.7	8.5	10.3	7.2	0
Woonsocket sewage & industrial waste																
	B-3	14.7	1.5	0.4	0.2	0.8	9.1	0.5	0.1	0.9	2.9	4.7	2.1	9.1	0.1	90
Dam at Manville																
	B-3A	14.6	5.8	6.3	6.0	6.0	-	6.1	5.6	6.0	7.2	8.1	6.3	8.1	5.8	0
Manville sewage & industrial waste, Albion Sew. (above dam at Ashton)																
	B-2	11.4+	4.4	2.5	3.2	3.6	10.1	2.9	4.2	2.6	4.6	4.4	4.3	10.1	2.5	90
Ashton & Berkeley sewers																
	B-1	6.9	3.6	4.4	2.9	3.6	9.8	5.8	4.2	3.9	5.8	5.9	5.0	9.8	2.9	60

Table 24
Dissolved Oxygen
(in mg/l)
Tributaries of Blackstone River
August, 1964 Survey

	Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17	Avg.	Max.	Min.	% less than 5.0
Quinsigamond River		B-39.7														
	Q-1	1.8	9.2	11.7	5.4	9.8	13.0	7.4	4.2	7.6	2.6	2.5	7.4	13.0	2.5	30
Mumford River		B-29.5														
	M-4	10.2	-	8.2	8.5	8.1	9.5	8.9	8.3	9.0	9.2	8.4	8.7	9.5	8.1	0
Hayward Woolen Co. (Div. Einiger)																
Hayward Schuster Woolen Mills, Inc.																
	M-3	5.6+	-	10.4	9.1	9.7	11.0	8.8	8.7	9.9	8.8	9.0	9.5	11.0	8.7	0
Whitinsville & Linwood																
	M-2	0.5+	7.4	5.8	7.5	5.9	6.4	8.1	5.3	10.0	9.7	6.6	7.3	10.0	5.3	0
Dam, Uxbridge Sewage & Emile Bernat																
	M-1	0.4	7.5	7.8	8.0	6.6	7.4	7.6	7.0	8.5	11.6	7.1	7.9	11.6	6.6	0
West River		B-28.7														
Waucuntuck Woolen Mill																
	W-1	0.6	7.5	7.8	8.0	6.6	7.4	7.6	7.0	8.5	11.6	7.1	7.9	11.6	6.6	0
Branch River		B-21.9														
	BR-2	2.6	8.1	8.6	9.0	8.0	9.4	9.7	9.2	10.5	9.8	9.6	9.2	10.5	8.0	0
Stamina Mills																
Branch R. Wool Combing Co.																
	BR-1	0.8	4.1	5.2	6.4	6.0	6.1	6.1	5.0	5.7	9.0	4.1	5.8	9.0	4.1	20

Table 25
Dissolved Oxygen
(in mg/l)
Ten Mile River
August, 1964 Survey

	Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17	Avg.	Max.	Min.	% less than 5.0
Ten Mile River																
Metal Plating Wastes Whiting Pond																
Metal Plating Wastes	T-9	19.8	7.2	9.1	7.4	9.0	9.0	8.8	7.8	9.6	9.0	9.1	8.6	9.6	7.2	0
North Attleboro Sewage Treatment Plant	T-8	16.8	7.9	11.8	6.4	8.3	13.0	6.5	6.6	10.3	9.2	8.8	8.9	13.0	6.4	0
Metal Plating Wastes	T-7	15.6	0.2	0.9	0.3	0.6	2.3	1.0	0.8	2.4	1.8	3.5	1.2	3.5	0.2	100
Dam & Dodgeville Finishing Co.	T-6A	11.6	-	18.9	9.0	18.0	18.4	19.8	18.2	20.0	18.8	21.2	18.0	21.2	9.0	0
Hebronville Dam Thompson Chemical Co.	T-6	9.3	13.8	11.7	14.2	4.7	19.2	17.2	9.6	20.0	16.6	16.3	14.3	20.0	4.7	10
Dam at Attleboro Dyeing & Finishing Co. Attleboro Dyeing & Finishing	T-5A	8.2	-	13.6	12.4	6.0/11.6	7.4	12.7	10.3	1.1	13.3	10.8	9.9	13.6	1.1	10
Attleboro Sewage Treatment Plant Mass.-Rhode Island State Line Seven Mile River enters	T-5	8.0	2.6	2.8	3.2	1.5/0.5	3.1	2.7	0.0	3.3	5.4	5.3	2.8	5.4	0.0	82
Rhode Island-Mass. State Line	T-4	7.4	1.8	2.8	9.6	4.1	7.8	3.0	6.7	5.8	7.2	3.3	5.2	9.6	1.8	50
Pawtucket Dyeing & Bleaching Mass.-Rhode Island State Line	T-3	7.0	1.7	0.7	8.4	6.6	5.6	5.5	5.6	4.0	8.8	3.0	5.0	8.8	0.7	40
Dam at Pawtucket Golf Club East Providence Waterworks Reservoir	T-2A	5.8+	-	-	5.1	6.6	8.1	9.3	5.7	5.8	10.2	7.6	7.3	10.2	5.1	0
E. Providence W.W. Reservoir Dam	T-2	2.5	14.9	9.4	3.6	7.6	8.6	7.9	8.0	8.0	10.3	8.8	8.7	14.9	3.6	10
	T-1	0.8	8.8	2.9	7.5	11.0	5.6	6.9	6.6	5.8	10.0	5.8	7.1	11.0	2.9	10
Tributary																
Seven Mile River	S-1	T-7.6 0.6	8.1	8.8	7.3	6.3	-	-	-	-	-	-	7.6	8.8	6.3	0

Table 26
SPECIAL DISSOLVED OXYGEN STUDY
Blackstone River
August 1964 Survey

B-7A (22.4)			B-7 (22.3)			B-7B (22.0)		
Time	Temp. °C	DO mg/1	Time	Temp. °C	DO mg/1	Time	Temp. °C	DO mg/1
TUES. 8-18-64								
8:00a	19.0	1.6	8:05a	18.0	6.6	-	-	-
12:35p	21.0	4.3	12:50p	21.5	8.2	-	-	-
4:00p	21.0	3.8	4:05p	21.0	7.7	3:50p	22.0	8.7
8:55p	19.0	2.9	8:50p	19.0	6.8	8:00p	19.0	7.4
WED. 8-19-64								
12:05a	19.0	2.4	12:15a	19.0	6.7	12:30a	18.5	7.3
4:00a	20.0	3.2	4:10a	19.5	6.8	4:20a	19.0	7.4
8:50a	20.0	5.3	9:00a	20.0	5.0	9:10a	20.0	5.8
1:30p	20.5	5.1	1:20p	20.0	5.4	1:40p	21.0	5.4
4:05p	21.0	4.5	4:10p	21.0	8.1	4:20p	22.0	8.8
7:40p	21.0	3.0	7:45p	21.0	7.0	7:55p	19.0	7.6
THURS. 8-20-64								
3:20p	21.0	3.8	3:30p	21.0	8.3	3:45p	21.0	8.9
11:45p	19.5	2.8	11:55p	19.0	6.5	11:30p	-	7.5
FRI. 8-21-64								
12:40a	19.5	3.4	12:45a	19.5	6.6	12:30a	19.0	7.4
2:25a	19.5	4.0	2:30a	18.0	6.7	3:15a	19.0	7.4
7:00a	19.0	5.4	7:05a	18.0	7.2	7:15a	18.5	7.9
11:15a	20.0	5.3	11:30a	20.0	7.9	11:45a	20.0	8.1
5:55p	20.5	3.8	6:05p	20.0	7.2	6:15p	20.5	7.8
10:10p	20.0	5.6	10:15p	19.5	7.1	10:30p	19.5	7.6
SAT. 8-22-64								
1:45a	20.0	4.4	2:30a	-	6.6	2:15a	-	7.0
6:30a	20.0	3.3	6:30a	19.5	6.4	6:40a	20.0	7.0
NO.		20			20			18
AVG.		3.9			6.8			7.5
MAX.		5.6			8.3			8.8
MIN.		1.6			5.0			5.4

Table 26
SPECIAL DISSOLVED OXYGEN STUDY
Blackstone River
August 1964 Survey
(Cont'd.)

B-6 (21.0)			B-5 (20.0)			B-4 (17.2)		
Time	Temp. °C	DO mg/l	Time	Temp. °C	DO mg/l	Time	Temp. °C	DO mg/l
TUES. 8-18-64								
8:15a	19.0	2.6	8:20a	19.5	2.3	9:10a	20.0	8.3
1:15p	21.0	4.5	1:30p	21.0	6.1	1:40p	22.0	9.1
4:15p	21.5	4.6	4:25p	21.0	6.2	5:40p	20.5	8.1
8:15p	20.0	3.6	8:25p	20.0	4.8	8:50p	20.5	6.8
WED. 8-19-64								
12:45a	20.0	1.1	12:55a	19.5	2.5	1:15a	20.0	6.9
4:35a	19.0	2.0	4:45a	20.0	1.5	5:00a	19.0	7.1
9:25a	19.5	2.6	9:40a	20.5	1.7	10:00a	20.5	7.8
1:55p	22.0	3.6	2:05p	20.0	5.2	2:20p	22.0	8.0
4:30p	22.5	4.0	4:40p	21.0	5.3	5:00p	22.0	7.7
8:00p	21.0	3.3	8:15p	21.0	4.0	8:45p	21.0	6.5
NO.		10			10			10
AVG.		3.2			4.0			7.6
MAX.		4.6			6.2			9.1
MIN.		1.1			1.5			6.5

B-3 (14.7)			B-3A (14.6)		
Time	Temp. °C	DO mg/l	Time	Temp. °C	DO mg/l
TUES. 8-18-64					
9:25a	20.0	2.1	9:40a	20.0	7.8
1:55p	23.0	7.1	2:15p	22.5	6.4
5:25p	21.0	0.8	5:20p	21.0	6.0
9:00p	20.0	0.1	9:05p	19.5	5.7
WED. 8-19-64					
1:30a	20.0	0.0	1:45a	20.0	5.7
5:15a	19.5	0.0	5:25a	19.0	5.8
10:15a	21.0	0.2	10:10a	21.0	0.9
2:30p	22.0	0.5	2:40p	22.0	2.3
5:20p	23.0	2.3	5:30p	22.0	4.9
8:55p	20.5	0.0	9:00p	20.5	5.6
NO.		10			10
AVG.		1.3			5.1
MAX.		7.1			7.8
MIN.		0.0			0.9

Table 26
SPECIAL DISSOLVED OXYGEN STUDY
Blackstone River
August 1964 Survey
(Cont'd.)

BR-2 (2.6)			BR-1 (0.8)		
Time	Temp. °C	DO mg/l	Time	Temp. °C	DO mg/l
TUES. 8-18-64					
8:45a	20.5	8.7	9:00a	20.0	4.6
12:15p	23.0	9.8	12:25p	19.0	4.8
4:45p	24.0	10.1	4:30p	22.0	5.0
8:35p	21.0	9.2	8:45p	21.0	2.8
WED. 8-19-64					
2:00a	21.0	8.6	2:10a	20.0	4.1
5:40a	20.5	8.3	5:55a	20.0	5.3
8:30a	21.0	8.7	8:40a	20.0	4.7
1:00p	23.0	9.6	1:10p	25.0	4.9
4:50p	22.0	9.6	5:00p	23.0	5.5
8:25p	21.0	9.6	8:35p	21.5	4.1
NO.		10			10
AVG.		9.2			4.6
MAX.		10.1			5.5
MIN.		8.3			2.8

Table 27
DISSOLVED OXYGEN (D.O. in mg/l)
COMPARISON OF SPECIAL & ROUTINE SURVEY DATA
Blackstone & Branch Rivers
August 1964 Survey

Station	River		Avg.	Wt.Avg.[1]	MAX.		MIN.	
No.	Mile	Special	Routine	S & R	Special	Routine	Special	Routine
BLACKSTONE RIVER								
B-7A	22.4	3.9	4.6	4.1	5.6	9.2	1.6	1.0
B-7	22.3	6.8	8.0	7.3	8.3	10.2	5.0	6.7
B-7B	22.0	7.5	-	-	8.8	-	5.4	-
B-6	21.0	3.2	3.9	3.6	4.6	5.6	1.1	2.3
B-5	20.0	4.0	3.8	3.9	6.2	6.4	1.5	2.0
B-4	17.2	7.6	8.5	8.0	9.1	10.3	6.5	7.2
B-3	14.7	1.3	1.3	1.3	7.1	9.1	0.0	0.1
B-3A	14.6	5,1	6.3	5.7	7.8	8.1	0.9	5.8
BRANCH RIVER								
BR-2	2.6	9.2	9.2	9.2	10.1	10.5	8.3	8.0
BR-1	0.8	4.6	5.8	5.2	5.5	9.0	2.8	4.1

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[1] Average is weighted according to number of samples in each series.

Table 28
SPECIAL D.O. STUDY
Ten Mile River
August 1964 Survey

T-6A (11.6)			T-6 (9.3)			T-5A (8.2)		
Time	Temp.	D.O.	Time	Temp.	D.O.	Time	Temp.	D.O.
THURS. 8-20			THURS. 8-20			THURS. 8-20		
8:45a	20	5.90	8:40a	20	13.38	8:55a	19	6.22
12:10p	22	20.95	12:00N	22	16.38	12:25p	22	12.16
4:15p	22	16.95	4:00p	22	16.97	4:30p	24	14.79
8:45p	21	15.00	8:30p	20	6.25	9:05p	21	6.30
						FRI. 8-21		
11:50p	20	13.45	11:45p	20	14.15	12:05a	19	3.55
FRI. 8-21			FRI. 8-21					
4:35a	20	13.30	4:25a	20	12.70	4:45a	20	5.65
8:15a	20	11.70	8:25a	20	13.60	8:35a	20	6.00
1:20p	24	15.20	1:35p	22	19.52	1:50p	22	14.66
3:55p	22	22.14	3:45p	24	16.43	4:05p	24	13.51
8:10p	22	21.00	8:00p	24	16.10	8:20p	22	8.40
11:30p	22	4.55	11:20p	22	3.00	11:40p	22	2.40
SAT. 8-22			SAT. 8-22			SAT. 8-22		
3:50a	22	18.55	3:40a	22	3.75	3:55a	21	5.80

NO.	12	12	12
AVG.	14.9	12.7	8.3
MAX.	22.1	19.5	14.8
MIN.	4.6	3.0	2.4

Table 28
SPECIAL D.O. STUDY
Ten Mile River
August 1964 Survey
(Cont'd.)

T-5 (8.0)			T-4 (7.4)			T-3 (7.0)		
Time	Temp.	D.O.	Time	Temp.	D.O.	Time	Temp.	D.O.
THURS. 8-20			THURS. 8-20			THURS. 8-20		
9:00a	19	5.62	9:10a	18	3.05	9:05a	18	1.80
12:40p	22	11.39	1:05p	22	6.99	12:55p	22	7.13
4:45p	22	4.30	5:00p	21	5.66	5:10p	22	5.69
9:20p	22	2.45	9:45p	20	1.60	9:35p	22	0.0
FRI. 8-21			FRI. 8-21			FRI. 8-21		
12:10a	20	2.05	12:30a	20	0.0	12:20a	20	0.0
4:55a	18	1.75	5:10a	18	0.0	5:05a	18	0.0
9:00a	20	3.27	9:30a	19	2.08	9:15a	19	0.90
2:10p	22	8.14	2:30p	24	10.01	2:25p	23	-
4:15p	22	6.65	4:35p	22	6.93	4:30p	23	6.95
8:30p	22	1.55	8:50p	21	3.55	8:45p	22	0.0
			SAT. 8-22			SAT. 8-22		
11:50p	21	0.55	12:05a	20	0.0	11:55p	21	0.0
SAT. 8-22								
4:05a	21	1.55	4:20a	20	0.0	4:15a	20	0.0
NO.		12			12			12
AVG.		4.1			3.3			2.0
MAX.		11.4			10.0			7.1
MIN.		0.6			0.0			0.0

Table 28
SPECIAL D.O. STUDY
Ten Mile River
August 1964 Survey
(Cont'd.)

T-2A (5.8^{+})			T-2 (2.5)		
Time	Temp.	D.O.	Time	Temp.	D.O.
THURS. 8-20			THURS. 8-20		
9:20a	19	5.36	9:30a	21	11.33
1:20p	22	9.22	1:40p	22	9.40
5:25p	22	6.38	-	-	-
10:00p	20	6.75	10:30p	20	14.45
FRI. 8-21			FRI. 8-21		
12:40a	20	6.40	12:50a	20	7.20
5:20a	19	5.10	5:35a	20	7.00
9:45a	20	6.28	10:00a	22	11.21
2:55p	24	10.19	3:15p	24	17.63
4:50p	24	10.66	5:05p	23	16.04
9:00p	22	7.45	9:20p	22	15.05
SAT. 8-22			SAT. 8-22		
12:15a	22	2.20	12:30a	22	3.65
4:30a	21	4.05	4:45a	21	10.1
NO.		12			11
AVG.		6.7			11.2
MAX.		10.7			16.0
MIN.		2.2			3.6

Table 29
DISSOLVED OXYGEN
COMPARISON OF SPECIAL & ROUTINE SURVEY DATA
Ten Mile River
August 1964 Survey

				Wt.Avg.	MAX.		MIN.	
STA.	R.M.	Special	Routine	S & R	Special	Routine	Special	Routine
T-6A	11.6	14.9	18.0	16.3	22.1	21.2	4.6	9.0
T-6	9.3	12.7	14.3	13.4	19.5	20.0	3.0	4.7
T-5A	8.2	8.3	9.9	9.0	14.8	13.6	2.4	1.1
T-5	8.0	4.1	2.8	3.5	11.4	5.4	0.6	0.0
T-4	7.4	3.3	5.2	4.2	10.0	9.6	0.0	1.8
T-3	7.0	2.0	5.0	3.4	7.1	8.8	0.0	0.7
T-2A	5.8^{+}	6.7	7.3	6.9	10.7	10.2	2.2	5.1
T-2	2.5	11.2	8.7	10.0	16.0	14.9	3.6	3.6

Table 30
Temperature
(Values in °C)
Blackstone River
August, 1964 Survey

Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17	No. of Samples	Avg.	Max.	Min.
Blackstone River															
B-14	46.9	20	22	22	25	22	22	22	25	20	20	10	22	25	20
B-13	46.0	20	24	22	23	21	22	22	24	20	20	10	22	24	20
B-12	40.5	20	23	21	20	21	21	22	22	18	20	10	21	23	18
Quinsigamond River enters															
B-11E	39.7	-	-	-	-	21	21	22	21	21	20	6	21	22	20
B-11D	39.5	-	-	-	-	22	20	22	21	21	20	6	21	22	20
B-11C	39.0	-	-	-	-	21	21	22	22	20	20	6	21	22	20
B-11B	38.8	-	-	-	-	21	21	22	22	20	20	6	21	22	20
B-11A	36.9	20	23	22	22	22	20	22	-	20	20	9	21	23	20
B-11	36.8	20	23	22	23	20	21	21	-	20	20	9	21	23	20
B-10C	35.0+	-	-	-	-	20	21	21	23	21	20	6	21	23	20
B-10B	35.0-	-	-	-	-	20	21	21	23	21	20	6	21	23	20
B-10A	34.1	-	-	-	-	20	20	21	23	21	20	6	21	23	20
B-10	31.3	22	22	22	21	19	20	20	22	18	19	10	21	22	18
B-9	29.9+	23	21	22	21	19	20	20	22	19	20	10	21	23	19
Mumford & West rivers enter															
B-8A	27.7	-	-	-	-	20	20	20	22	20	20	6	20	22	20
B-8	24.5	19	21	21	21	20	20	20	22	19	20	10	20	22	19
B-7A	22.4	20	20	20	21	-	21	20	20	20	20	9	20	21	20
Mass. Rhode Island State line B-7	22.3	20	21	21	22	20	20	20	20	20	20	10	20	22	20
Branch River enters Rhode Island-Mass. State line															
B-6	21.0	20	20	20	21	20	20	21	20	20	18	10	20	21	18
Mass.-Rhode Island State line															
B-5	20.0	20	20	20	20	20	20	20	20	19	19	10	20	20	19
B-4	17.2	23	22	20	22	22	20	21	20	20	20	10	21	23	20
B-3	14.7	23	22	20	22	22	21/20	22	20	20	20	11	21	23	20
B-3A	14.6	22	22	21	23	-	21	22	21	20	20	9	21	23	20
B-2	11.4+	23	21	21	23	22	20	22	20	21	20	10	21	23	20
B-1	6.9	22	22	21	22	22	21	22	21	20	20	10	21	22	20

Table 31
Temperature
(Values in °C)
Blackstone River Tributaries
August, 1964 Survey

Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17	No. of Samples	Avg.	Max.	Min.
Quinsigamond River	B-39.7														
Q-1	1.8	20	23	20	22	21	20	21	20	16	18	10	20	23	16
Mumford River	B-29.5														
M-4	10.2	-	20	22	20	21	20	20	22	20	18	9	20	22	18
M-3	5.6	-	22	22	22	24	22	22	22	21	21	9	22	24	21
M-2	0.5	23	21	22	21	20	21	22	22	22	20	10	22	23	20
M-1	0.4	22	22	23	22	20	21	22	22	20	20	10	21	23	20
West River	B-28.7														
W-1	0.6	21	21	20	20	18	19	20	20	18	20	10	20	21	18
Branch River	B-21.9														
BR-2	2.6	22	22	22	22	23	22	22	23	21	21	10	22	23	21
BR-1	0.8	22	24	23	20	22	22	22	24	20	21	10	22	24	20

Table 32
Temperature
(Values in °C)
Ten Mile River & Tributary
August, 1964 Survey

Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17	No. of Samples	Avg.	Max.	Min.
Whiting Pond															
T-9	19.8	20	22	21	24	22	20	21	22	20	21	10	21	24	20
T-8	16.8	16	21	18	20	21	18	21	22	17	19	10	19	22	17
T-7	15.6	17	21	18	18	22	18	20	24	17	18	10	19	24	17
T-6A	11.6	-	22	22	22	22	21	21	22	20	20	9	21	22	20
T-6	9.3	20	21	22	22	21	20	21	24	21	20	10	21	24	20
T-5A	8.2	-	22	22	20/25	21	20	21	21	23	20	10	22	25	20
T-5	8.0	20	22	20	20/24	19	20	22	21	22	19	11	21	24	19
Mass.-Rhode Island State line Seven Mile River enters															
T-4	7.4	23	19	22	24	20	20	22	21	21	18	10	21	24	18
Rhode Island-Mass. State line Mass.-Rhode Island State line															
(St.line) T-3	7.0	25	20	22	24	20	20	22	21	22	18	10	21	24	18
T-2A	5.8+	-	-	24	25	19	21	22	20	22	19	8	22	25	19
T-2	2.5	25	22	24	22	21	20	22	21	22	20	10	22	25	20
T-1	0.8	23	20	22	24	20	20	22	20	21	19	10	21	24	19
Tributary															
Seven Mile River	T-7.6														
S-1	0.6	17	20	18	16	-	-	-	-	-	-	4	18	20	16

Table 33
Hydrogen Ion Concentration - pH
Blackstone & Ten Mile Rivers
August, 1964 Survey

Station No.	River Mile	8-4		8-5		8-6		8-7		8-10		8-11		8-12		8-13		8-14		8-17		Avg.		[illegible] Max.		Min.	
		Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.	Fld.	Lab.
Blackstone River																											
B-14	46.9	6.2	6.3	7.4	3.7	7.2	6.1	6.0	4.2	6.8	7.7	7.2	-	5.8	6.4	6.4	-	5.2	4.3	5.2	-	6.3	5.5	7.4	7.7	5.2	3.7
B-13	46.0	6.6	6.7	7.2	6.8	7.2	6.3	6.0	3.5	6.8	7.1	6.2	6.7	6.6	7.0	5.2	5.0	6.0	6.6	6.4	6.8	6.4	6.2	7.2	7.1	5.2	3.5
B-12	40.5	7.0	7.1	7.2	6.3	7.2	6.7	6.0	6.0	6.6	7.2	6.4	6.8	6.2	6.1	5.6	6.9	6.2	6.5	6.8	7.2	6.6	6.7	7.2	7.2	6.0	6.0
Quinsigamond River enters																											
B-11A	36.9	6.8	-	-	-	-	-	-	-	6.6	-	6.4	-	6.6	-	-	-	6.4	-	6.4	-	6.5	-	6.8	-	6.4	-
B-11	36.8	7.0	7.2	7.2	7.2	7.2	7.0	6.6	6.9	6.8	6.9	6.6	6.9	6.8	7.1	6.4	-	6.6	6.9	6.6	7.0	6.9	7.0	7.2	7.2	6.4	6.9
B-10	31.3	6.8	7.1	6.6	6.8	7.2	7.0	6.2	6.5	6.9	6.7	7.0	-	7.1	6.8	6.6	-	6.3	6.8	6.3	-	6.7	6.8	7.2	7.1	6.2	6.5
B-9	29.9+	7.0	7.2	7.2	6.9	6.6	6.9	6.3	6.4	6.6	6.7	6.9	-	6.9	6.8	6.4	-	6.4	6.6	6.2	-	6.6	6.8	7.2	7.2	6.2	6.4
Mumford River enters																											
West River enters																											
B-8A	27.7	-	-	-	-	-	-	-	-	6.3	6.5	7.1	-	6.9	6.6	6.3	-	6.4	6.6	6.2	-	6.5	6.6	7.1	6.6	6.2	6.5
B-8	26.5	6.2	6.5	6.1	6.5	6.3	6.4	6.3	6.3	6.2	6.2	7.1	-	7.0	6.4	6.3	-	6.5	6.5	6.3	-	6.4	6.4	7.0	6.5	6.1	6.2
B-7A	22.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.9	-	6.7	-	-	-	6.8	-	6.9	-	6.7	-
B-7	22.3	6.4	6.8	6.2	6.6	7.1	6.6	7.1	6.2	6.4	6.5	7.3	6.2	7.0	6.3	7.0	6.3	6.5	6.7	6.8	-	6.8	6.5	7.1	6.8	6.2	6.2
Branch River enters																											
B-6	21.0	6.5	7.0	6.5	7.0	6.4	6.9	6.4	6.7	6.6	6.6	7.0	6.6	6.9	6.7	6.3	6.8	6.4	6.8	7.1	6.8	6.6	6.8	7.1	7.0	6.3	6.6
B-5	20.0	6.5	7.0	6.6	6.8	6.5	7.2	6.4	6.8	6.5	6.8	6.9	6.8	6.8	6.6	6.3	6.9	6.4	6.7	7.1	6.8	6.6	6.8	7.1	7.2	6.4	6.6
B-4	17.2	7.2	7.3	6.7	7.0	6.7	7.0	7.1	7.2	7.3	7.2	7.1	-	6.7	7.2	6.7	-	6.5	7.0	6.7	-	6.9	7.1	7.3	7.3	6.5	7.0
B-3	14.7	7.2	6.9	7.3	6.9	6.5	6.9	7.1	6.8	6.9	7.1	6.8/6.3	-	6.6	7.3	6.4	-	6.3	6.7	6.4	-	6.7	6.9	7.3	7.3	6.3	6.7
B-3A	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.5	-	6.7	-	6.6	-	6.7	-	6.5	-
B-2	11.4+	7.3	6.8	7.2	6.8	6.5	7.0	6.9	6.8	7.1	7.2	6.6	-	6.6	7.0	6.6	-	6.5	6.8	6.7	-	6.8	6.9	7.3	7.2	6.5	6.8
B-1	6.9	7.2	6.7	7.2	7.0	6.4	6.8	6.6	6.8	7.0	7.0	6.7	-	6.7	6.9	6.5	-	6.6	7.1	6.5	-	6.7	6.9	7.2	7.1	6.4	6.7
Blackstone Tributaries																											
Quinsigamond River B-39.7																											
Q-1	1.8	7.4	7.5	8.8	8.0	7.2	7.2	7.4	7.4	6.8	-	6.8	-	6.6	-	6.8	-	6.6	-	6.4	-	7.1	7.5	8.8	8.0	6.4	7.2
Mumford River B-29.5																											
M-4	10.2	-	-	6.2	6.5	6.4	6.7	6.2	6.2	6.0	-	6.0	-	6.0	-	6.0	-	5.8	-	5.8	-	6.0	6.5	6.4	6.7	5.8	6.2
M-3	5.6+	-	-	7.2	6.9	6.2	6.5	6.4	6.1	6.4	-	6.0	-	5.8	-	6.0	-	5.8	-	5.8	-	6.2	6.5	7.2	6.9	5.8	6.1
M-2	0.5+	6.6	7.0	6.6	6.7	7.1	6.8	7.1	6.7	6.4	6.8	6.6	-	6.2	-	6.6	-	6.8	-	6.4	-	6.6	6.8	7.1	7.0	6.2	6.7
M-1	0.4	6.6	7.1	6.4	6.8	7.1	6.8	7.3	6.7	6.2	6.9	6.4	6.6	6.4	6.6	6.6	6.7	6.6	7.0	6.2	7.0	6.6	6.8	7.3	7.1	6.2	6.6
West River B-28.7																											
W-1	0.6	6.6	7.1	7.2	6.8	6.4	6.8	7.1	6.7	6.0	-	6.4	-	6.4	-	6.2	-	6.2	-	6.4	-	6.5	6.8	7.2	7.1	6.0	6.7
Branch River B-21.9																											
BR-2	2.6	6.9	7.3	7.0	7.1	6.9	7.2	6.9	6.8	7.3	7.1	7.3	7.4	7.2	7.6	7.4	7.6	7.4	8.3	7.1	8.6	7.1	7.5	7.4	8.6	6.9	6.8
BR-1	0.8	7.1	7.8	7.3	7.9	7.2	7.4	6.9	7.3	7.4	7.8	7.2	7.3	7.4	8.0	7.4	8.0	7.1	6.8	7.5	8.2	7.2	7.6	7.5	8.2	6.9	6.8
Ten Mile River																											
T-9	19.8	7.5	7.6	7.5	7.5	7.1	7.3	7.5	7.0	7.5	-	7.3	7.7	7.1	-	8.0	7.6	7.5	-	7.3	-	7.4	7.4	8.0	7.6	7.1	7.0
T-8	16.8	7.1	7.4	7.1	7.3	6.9	7.1	-	7.0	7.8	-	6.7	7.2	6.9	-	7.3	7.1	6.3	-	7.1	7.2	7.0	7.2	7.8	7.4	6.3	7.0
T-7	15.6	6.7	7.2	6.9	7.0	6.7	7.0	6.5	6.8	7.7	-	6.3	7.2	6.5	-	6.7	7.1	6.2	-	6.1	6.8	6.6	7.0	7.7	7.2	6.1	6.8
T-6	9.3	8.4	8.9	7.4	7.4	8.5	8.7	6.7	8.5	8.9	-	8.3	9.3	7.2	-	9.1	9.2	8.7	-	8.7	8.7	8.2	8.7	9.1	9.3	6.7	8.5
T-5A	8.2	-	-	-	-	-	-	-	-	7.1	7.1	8.3	8.2	6.4	6.7	7.1	7.3	8.9	8.3	7.3	7.5	7.5	7.5	8.9	8.3	6.4	6.7
T-5	8.0	6.7	7.2	6.7	6.8	6.9	6.9	6.7	6.9	6.6	7.5	6.9	7.0	6.5	6.8	6.7	7.0	6.8	6.9	6.6	7.0	6.7	7.0	6.9	7.5	6.5	6.8
Seven Mile River enters																											
T-4	7.4	6.9	7.2	6.9	7.0	7.1	7.1	6.9	7.2	7.2	7.0	6.9	7.0	7.1	7.0	6.5	7.0	6.7	6.8	6.6	7.0	6.9	7.0	7.2	7.2	6.5	6.8
T-3	7.0	7.1	7.3	8.1	8.4	7.1	7.2	-	7.2	6.9	6.9	6.8	7.0	6.9	7.1	6.7	7.0	6.9	7.0	6.7	7.0	7.0	7.2	8.1	8.4	6.7	6.9
T-2	2.5	8.9	9.5	7.1	7.0	-	9.2	7.3	7.3	7.7	-	7.3	7.4	7.5	-	7.5	7.5	8.8	-	8.3	7.8	7.8	8.0	8.9	9.5	7.3	7.0
T-1	0.8	6.9	7.4	6.5	7.1	7.1	7.5	7.7	7.6	7.0	-	7.0	-	7.1	-	6.9	-	7.3	-	6.9	-	7.0	7.4	7.7	7.6	6.5	7.1
Ten Mile Tributary																											
Seven Mile River T-7.6																											
S-1	0.6	6.5	6.7	6.9	6.8	6.5	7.0	6.3	6.9	-	-	-	-	-	-	-	-	-	-	-	-	6.6	6.8	6.9	7.0	6.3	6.7

Table 34
Metals
Ten Mile River
(Values in mg/l)
August, 1964

	Station	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	No. of Samples	Avg.	Max.	Min.
Copper													
	T-9	T-19.8	0.24	0.16	0.22	0.26	0.24	0.29	0.24	7	0.24	0.29	0.16
	T-7	15.6	0.30	0.14	0.06	0.24	0.26	0.32	0.28	7	0.23	0.32	0.06
	T-6	9.3	0.50	0.56	0.66	0.55	0.64	0.70	0.58	7	0.60	0.70	0.50
	T-4	7.4	0.40	0.41	0.52	0.28	0.50	0.52	-	6	0.44	0.52	0.28
	T-2	2.5	0.61	0.38	0.33	0.44	0.48	0.29	0.34	7	0.41	0.61	0.29
Cadmium													
	T-9	19.8	0.00	0.00	0.00	0.00	0.04	0.00	0.00	7	0.01	0.04	0.00
	T-7	15.6	0.00	0.11	0.05	0.00	0.00	0.00	0.00	7	0.02	0.11	0.00
	T-6	9.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7	0.00	0.00	0.00
	T-4	7.4	0.00	0.00	0.00	0.05	0.00	0.00	0.00	6	0.01	0.05	0.00
	T-2	2.5	0.00	0.00	0.00	0.00	0.00	Tr.	0.00	7	0.00	Tr.	0.00
Nickel													
	T-9	19.8	0.04	0.00	0.01	Tr.	0.01	0.04	0.00	7	0.01	0.04	0.00
	T-7	15.6	0.10	0.08	0.14	0.14	0.08	0.18	0.18	7	0.13	0.18	0.08
	T-6	9.3	0.51	0.57	0.47	0.45	1.29	1.28	0.39	7	0.71	1.29	0.39
	T-4	7.4	0.23	0.24	0.25	0.28	0.37	0.42		6	0.30	0.42	0.23
	T-2	2.5	0.10	0.06	0.05	0.07	0.08	0.09	0.09	7	0.08	0.10	0.05
Zinc													
	T-9	19.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7	0.00	0.00	0.00
	T-7	15.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7	0.00	0.00	0.00
	T-6	9.3	0.50	0.55	0.00	0.48	0.00	0.33	0.00	7	0.26	0.55	0.00
	T-4	7.4	0.00	0.00	0.00	0.00	0.00	0.00	-	6	0.00	0.00	0.00
	T-2	2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7	0.00	0.00	0.00
Chromium													
	T-9	19.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7	0.00	0.00	0.00
	T-7	15.6	0.00	0.07	0.00	0.00	0.00	0.00	0.00	7	0.01	0.07	0.00
	T-6	9.3	0.00	0.00	0.00	0.00	0.05	0.00	0.00	7	0.01	0.05	0.00
	T-4	7.4	0.00	0.12	0.07	0.00	0.00	0.00	-	6	0.03	0.12	0.00
	T-2	2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.04	7	0.00	0.04	0.00

Table 35
A. B. S.
Blackstone River & Ten Mile River
(Values in mg/l)
August, 1964 Survey

Station	River Mile	Tues. 8-4	Wed. 8-5	Thurs 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	No. of Samples	Avg.	Max.	Min.
Blackstone River													
B-14	46.9	-	-	-	-	0.36	-	0.40	-	2	0.38	0.40	0.36
B-13	46.0	1.00	0.84	0.90	1.00	0.80	>2.0	1.00	0.50	8	>1.00	>2.0	0.50
B-12	40.5	-	-	-	-	-	-	0.96	0.60	2	0.78	0.96	0.60
B-11C	39.0	-	-	-	-	-	-	1.15	-	1	1.15	1.15	1.15
B-11	36.8	0.65	0.76	1.14	1.00	1.25	1.06	1.30	-	7	1.02	1.30	0.65
B-10	31.3	-	-	-	-	-	-	0.95	-	1	0.95	0.95	0.95
B-9	29.9+	0.83	0.80	0.75	0.80	0.75	-	0.85	-	6	0.80	0.85	0.75
B-8	24.5	-	-	-	-	-	-	0.62	-	1	0.62	0.62	0.62
B-7	22.3	0.67	0.46	0.48	0.68	0.68	0.72	0.70	0.68	8	0.63	0.72	0.46
B-6	21.0	-	-	-	-	-	0.58	0.48	0.52	3	0.53	0.58	0.48
B-5	20.0	-	-	-	-	0.57	-	0.50	0.51	3	0.53	0.57	0.50
B-4	17.2	-	-	-	-	-	-	0.33	-	1	0.33	0.33	0.33
B-3	14.7	0.87	0.63	0.70	0.70	0.58	-	0.54	-	6	0.67	0.87	0.54
B-2	11.4	-	-	-	-	-	-	0.70	-	1	0.70	0.70	0.70
B-1	6.9	-	-	-	-	0.62	-	0.55	-	2	0.58	0.62	0.55
Tributaries of Blackstone River													
BR-1	21.9-0.8	0.44	0.27	0.20	0.28	0.37	0.22	0.18	0.38	8	0.29	0.44	0.18
BR-2	21.9-2.6	-	-	-	-	0.14	0.07	0.10	0.15	4	0.11	0.15	0.07
M-1	29.5-0.4	0.55	0.28	0.43	0.35	0.46	0.58	0.70	-	7	0.48	0.70	0.28
Sewage Treatment Effluent													
Worcester Sewage Treatment Plant		-	-	-	-	-	-	1.00	-	1	1.00	1.00	1.00
Ten Mile River													
T-9	19.0	-	-	-	-	-	0.10	-	0.08	2	0.09	0.10	0.08
T-8	16.8	-	-	-	-	-	0.20	-	0.20	2	0.20	0.20	0.20
T-7	15.6	-	-	-	-	-	-	-	1.40	1	1.40	1.40	1.40
T-6	9.3	-	-	-	-	-	-	0.35	0.32	2	0.34	0.35	0.32
T-5	8.0	-	-	-	-	-	0.43	-	0.30	2	0.36	0.43	0.30
T-5A	8.3	-	-	-	-	-	0.50	0.34	0.50	3	0.45	0.50	0.34
T-4	7.4	-	-	-	-	-	0.64	0.18	-	2	0.41	0.64	0.18
T-3	7.0	-	-	-	-	-	0.79	0.55	0.50	3	0.61	0.79	0.50
T-2	2.5	-	-	-	-	-	-	-	0.25	1	0.25	0.25	0.25
Sewage Treatment Effluent													
Attleboro Sewage Treatment Plant		-	-	-	-	-	> 2.0	-	> 2.0	2	> 2.00	> 2.00	> 2.00
North Attleboro Sewage Treatment Plant		-	-	-	-	-	> 2.0	-	> 2.0	2	> 2.00	> 2.00	> 2.00

Table 36
Nitrogen Studies
(Values in mg/1)
Blackstone River
August, 1964 Survey

Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17	No. of Samples	Avg.	Max.	Min.
Nitrates (NO_3^- in mg/1)															
B-13	46.0	0.65	1.95	0.23	0.62	2.52	1.43	1.27	1.22	1.80	2.32	10	1.40	2.52	0.23
B-12	40.5	-	-	-	-	-	-	-	2.16	1.81	1.06	3	1.68	2.16	1.06
B-11	36.8	2.06	0.92	0.70	0.77	1.12	0.97	0.66	-	1.20	0.76	9	1.02	2.06	0.66
B-9	30.0	2.03	2.06	1.76	2.00	2.17	-	1.79	-	1.77	2.04	8	1.95	2.17	1.76
B-7	22.3	2.07	1.93	1.96	2.20	2.41	2.55	2.36	2.15	-	2.40	9	2.22	2.55	1.93
B-3	14.7	1.20	0.98	0.68	0.46	1.12	-	0.63	-	1.66	1.74	8	1.06	1.74	0.46
BR-1	21.9-0.8	0.35	0.41	0.33	0.21	0.50	0.44	-	0.43	-	0.59	8	0.41	0.59	0.21
M-1	29.5-0.4	0.54	0.49	0.21	0.20	0.18	0.16	0.14	-	0.21	0.13	9	0.25	0.54	0.13
Nitrites (NO_2^- in mg/1)															
B-13	46.0	0.004	0.005	0.002	0.004	0.006	0.004	0.003	0.004			8	0.004	0.005	0.002
B-12	40.5	-	-	-	-	-	-	-	0.002			1	0.002	0.002	0.002
B-11	36.8	0.003	0.004	0.002	0.004	0.004	0.003	0.002	-			7	0.003	0.004	0.002
B-9	30.0	0.002	0.004	0.001	0.004	0.003	-	0.002	-			6	0.003	0.004	0.001
B-7	22.3	0.001	0.004	0.001	0.003	0.003	0.003	0.002	0.001			8	0.002	0.004	0.001
B-3	14.7	0.004	0.020	0.007	0.004	0.003	-	0.007	-			6	0.008	0.020	0.003
Blackstone River Tributaries															
Branch River	21.9														
BR-1	0.8	0.001	0.003	0.001	0.001	0.001	0.001	-	0.001			7	0.001	0.003	0.001
Mumford River	29.5														
M-1	0.4	0.001	0.001	0.003	0.003	0.003	0.001	0.001	-			7	0 002	0.003	0.001
Ammonia (NH_3 in mg/1)															
B-13	46.0	2.2	3.6	0.6	1.2	5.0	0.1	4.3	1.3			8	2.3	5.0	0.1
B-12	40.5	-	-	-	-	-	-	-	0.7			1	0.7	0.7	0.7
B-11	36.8	0.1	2.6	1.4	4.3	3.0	2.5	2.6	-			7	2.4	4.3	0.1
B-9	30.0	2.9	1.6	0.6	1.4	2.0	-	2.5	-			6	1.8	2.9	0.6
B-7	22.3	0.3	0.2	0.1	0.0	0.6	0.2	0.4	0.4			8	0.3	0.6	0.0
B-3	14.7	1.0	0.8	0.4	0.5	0.2	-	0.7	-			6	0.6	1.0	0.2
Blackstone Tributaries															
Branch River	21.9														
BR-1	0.8	1.1	2.9	1.9	0.4	4.6	0.5	-	3.6			7	2.1	4.6	0.4
Mumford River	29.5														
M-1	0.4	0.7	0.6	0.2	0.2	0.4	0.5	0.7	-			7	0.5	0.7	0.2

Table 37
Sampling Times
Blackstone River
August 1964 Survey

	Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17
Blackstone River	B-14	46.9	9:20A	1:30P	8:40A	11:55A	2:20P	11:25A	12:45P	2:00P	8:40A	9:00A
	B-13	46.0	9:40A	1:45P	8:55A	11:40A	2:30P	11:40A	12:05P	1:45P	8:10A	8:50A
	B-12	40.5	11:50A	2:30P	9:40A	10:50A	3:10P	12:35P	1:15P	10:45A	9:10A	8:15A
Quinsigamond River Enters												
	B-11E	39.7	-	-	-	-	3:30P	1:00P	1:35P	11:10A	11:30A	7:55A
	B-11D	39.5	-	-	-	-	3:35P	12:50P	1:25P	11:00A	11:35A	8:05A
	B-11C	38.9	-	-	-	-	3:40P	1:10P	1:45P	11:20A	9:30A	10:55A
	B-11B	38.8	-	-	-	-	3:45P	1:20P	1:50P	11:15A	9:35A	11:05A
	B-11A	37.0	11:10A	2:55P	9:55A	10:40A	3:55P	1:30P	2:00P	-	9:50A	11:20A
	B-11	36.8	11:15A	3:05P	10:10A	10:30A	10:25A	1:40P	11:25A	11:50A	10:00A	11:30A
	B-10C	35.0^+	-	-	-	-	10:40A	1:50P	11:10A	3:45P	1:15P	11:40A
	B-10B	35.0^-	-	-	-	-	10:45A	1:55P	11:15A	3:35P	1:10P	11:45A
	B-10A	34.1	-	-	-	-	11:05A	2:15P	11:25A	3:25P	12:55P	11:55A
	B-10	31.3	4:05P	11:00A	11:55A	9:00A	10:00A	4:20P	9:55A	1:45P	8:10A	12:55P
	B-9	30.0	2:15P	9:45A	2:00P	9:40A	10:30A	4:05P	10:15A	2:10P	8:30A	12:35P

Table 37
Sampling Times
Blackstone River
August 1964 Survey

Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17
Mumford & West Rivers Enter											
B-8A	27.7	-	-	-	-	10:45A	3:50P	10:30A	2:35P	9:00A	12:15P
B-8	24.5	9:00A	11:35A	11:20A	10:15A	11:00A	3:35P	10:45A	2:55P	9:25A	12:00N
B-7A	22.4	9:25A	10:55A	10:50A	10:35A	-	3:10P	11:00A	11:25A	9:45A	10:25A
B-7	22.3	9:40A	11:05A	11:00A	10:45A	11:25A	3:20P	11:10A	11:40A	10:00A	10:35A
Branch River Enters											
B-6	21.0	10:05A	10:40A	10:30A	11:05A	11:50A	11:25A	11:25A	11:10A	10:15A	10:05A
B-5	20.0	10:30A	10:20A	10:20A	11:20A	12:05P	11:10A	11:40A	10:55A	10:30A	9:50A
B-4	17.2	12:30P	9:30A	8:05A	11:55A	2:00P	10:55A	3:15P	10:40A	12:10P	9:30A
B-3	14.7	12:55P	9:00A	8:30A	12:15P	2:20P	2:40P 10:35A	3:35P	10:15A	12:30P	9:00A
B-3A	14.6	1:15P	9:15A	8:40A	12:30P	-	2:30P	3:50P	10:25A	12:45P	9:15A
B-2	11.4	1:45P	8:00A	9:00A	12:50P	2:45P	10:15A	4:10P	9:55A	1:00P	8:35A
B-1	6.9	3:45P	8:25A	9:20A	1:15P	3:10P	9:55A	4:35P	9:30A	1:20P	8:15A

Table 38
Sampling Times
Blackstone River Tributaries
August 1964 Survey

Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues. 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17
Quinsigamond River	39.7										
Q-1	39.7-1.0	10:20A	12:15P	9:20A	11:10A	2:55P	12:20P	1:05P	10:30A	9:00A	8:30A
Mumford River	29.5										
M-4	29.5-10.2	-	8:15A	12:30P	8:15A	1:50P	10:35A	9:30A	2:20P	12:00N	7:15A
M-3	29.5- 5.6	-	8:45A	1:00P	8:35A	1:30P	10:20A	9:45A	2:35P	12:25P	7:30A
M-2	29.5- 0.5	3:35P	10:15A	12:35P	9:00A	11:50A	3:00P	10:10A	2:55P	2:10P	12:35P
M-1	29.5- 0.4	3:20P	10:00A	1:10P	9:15A	11:40A	2:50P	10:25A	3:00P	2:00P	12:30P
West River	28.7										
W-1	28.7- 0.6	5:00P	9:25A	1:45P	9:30A	11:30A	2:30P	10:40A	9:55A	1:45P	12:15P
Branch River	21.9										
BR-2	21.9- 2.6	11:35A	12:00N	11:40A	8:30A	12:40P	4:50P	2:40P	3:10P	11:30A	1:25P
BR-1	21.9- 0.8	11:15A	12:25P	12:00N	8:15A	12:25P	5:05P	2:25P	3:25P	11:50A	1:40P

Table 39
Sampling Times
Ten Mile River & Tributaries
August 1964 Survey

	Station Number	River Mile	Tues. 8-4	Wed. 8-5	Thurs. 8-6	Fri. 8-7	Mon. 8-10	Tues 8-11	Wed. 8-12	Thurs. 8-13	Fri. 8-14	Mon. 8-17
Whiting Pond												
	T-9	19.8	8:50A	11:45A	8:45A	10:45A	3:20P	10:00A	9:45A	3:50P	10:20A	10:20A
	T-8	16.8	9:30A	12:15P	9:10A	10:25A	3:00P	10:45A	10:15A	3:40P	10:45A	10:40A
	T-7	15.6	10:00A	12:35P	9:20A	10:10A	2:45P	11:00A	10:35A	3:20P	11:00A	11:05A
	T-6A	11.6	-	1:00P	9:50A	9:55A	2:20P	12:00N	10:50A	3:00P	11:35A	1:50P
	T-6	9.3	10:45A	1:15P	10:00A	9:40A	2:00P	12:10P	11:00A	2:50P	11:45A	1:30P
	T-5A	8.3	-	2:00P	11:00A	9:20A 4:15P	10:30A	3:05P	5:30P	11:55A	5:10P	3:25P
	T-5	8.0	11:15A	1:45P	10:25A	9:00A 4:00P	10:00A	2:55P	5:40P	12:10P	5:25P	3:35P
Seven Mile River Enters		7.6										
	T-4	7.4	4:50P	9:35A	12:40P	4:45P	11:45A	3:40P	5:00P	11:20A	4:50P	2:20P
	T-3	7.0	4:35P	9:25A	12:50P	4:55P	12:00N	3:30P	5:15P	11:40A	5:00P	2:05P
	T-2A	5.8	-	-	2:05P	5:50P	11:30A	3:55P	4:45P	10:35A	4:35P	2:35P
	T-2	2.5	3:10P	9:00A	1:40P	5:30P	11:10A	4:15P	4:30P	11:00A	4:00P	3:00P
	T-1	0.6	4:05P	8:30A	1:15P	5:15P	10:50A	4:30P	4:20P	10:20A	4:15P	2:50P
Tributaries												
Seven Mile River		7.6										
	S-1	7.6-0.6	11:45A	4:15P	11:05A	8:40A	-	-	-	-	-	-

Table 40
River Discharge
During August, 1964 Survey
Blackstone River & Tributaries

	Station Number	River Mile	Flow cfs
	B-14	46.9	40.8
Worcester sewage			34.0
	B-13	46.0	74.8
	B-12	40.5	79.2
Quinsigamond River enters			2.4 (1)
	B-11C	38.9	82.9
	B-11A	37.0	84.4
	B-11	36.8	84.4
U.S.G.S. Gage	-	36.7	84.6 (1)
	B-10	31.3	85.1
	B-9	30.0	85.2
Mumford River enters			20.0
West River enters			3.6 (1)
	B-8A	27.7	109.0
	B-8	24.5	109.3
	B-7A	22.4	109.5
	B-7	22.3	109.5
Branch River enters			21.3 (1)
	B-6	21.0	130.9
	B-5	20.0	131.0
U.S.G.S. Gage	-	17.6	131.4 (1)
	B-4	17.2	131.5
Woonsocket Sewage			7.7
	B-3	14.7	139.4
	B-3A	14.6	139.4
	B-2	11.4	139.7
	B-1	6.9	140.1

(1) Average of U.S.G.S. provisional discharge data from 8/2/64 through 8/21/64.

Note: Other values are estimates; interpolated from U.S.G.S. discharge data, sewage flows, and occasional PHS field measurements.

Table 41
River Discharge
During August, 1964 Survey
Ten Mile River

	Station Number	River Mile	Flow cfs
	T-9	19.8	0.1
	T-8	16.8	2.0
No. Attleboro sewage enters	-	15.9	2.3
	T-7	15.6	5.1
Bungay River enters	-	14.8	3.0
	T-6A	11.6	10.8
	T-6	9.3	12.3
	T-5A	8.3	
	T-5	8.0	13.2
Attleboro sewage enters	-	7.8	2.8
Seven Mile River enters	-	7.6	3.2
	T-4	7.4	19.6
	T-3	7.0	19.9
E. Providence Waterworks intake	-		-3.2
	T-2	2.5	19.7
	T-1	0.8	20.8

Note: Discharge values are estimates based on a single PHS field measurement at each of the following stations: T-9, T-7, T-6A, T-5, and T-3. Discharges remained relatively stable during survey period.

Table 47
New England Interstate Water Pollution Control Commission
Classification and Standards of Quality for Interstate Waters
(As revised and adopted October 1, 1959)

	CLASS A	CLASS B	CLASS C	CLASS D
		SUITABILITY FOR USE		
	Suitable for any water use. Character uniformly excellent.	Suitable for bathing and recreation, irrigation and agricultural uses; good fish habitat; good aesthetic value. Acceptable for public water supply with filtration and disinfection.	Suitable for recreational boating, irrigation of crops not used for consumption without cooking; habitat for wildlife and common food and game fishes indigenous to the region; industrial cooling and most industrial process uses.	Suitable for transportation of sewage and industrial wastes without nuisance, and for power, navigation and certain industrial uses.
		STANDARDS OF QUALITY		
Dissolved oxygen	Not less than 75% sat.	Not less than 75% sat.	Not less than 5 p.p.m.	Present at all times
Oil and grease	None	No appreciable amount.	Not objectionable	Not objectionable
Odor, scum, floating solids, or debris	None	None	None	Not objectionable
Sludge deposits	None	None	None	Not objectionable
Color and turbidity	None	Not objectionable	Not objectionable	Not objectionable
Phenols and other taste producing substances	None	None	None	
Substances potentially toxic	None	None	Not in toxic concentrations or combinations	Not in toxic concentrations or combinations
Free acids or alkalies	None	None	None	Not in objectionable amounts
Radioactivity	Within limits approved by the appropriate State agency with consideration of possible adverse effects in downstream waters from discharge of radioactive wastes; limits in a particular watershed to be resolved when necessary after consultation between States involved.			
Coliform bacteria	* Within limits approved by State Department of Health for uses involved.	Bacterial content of bathing waters shall meet limits approved by State Department of Health and acceptability will depend on sanitary survey.		

* Sea waters used for taking of market shellfish shall not have a median coliform content in excess of 70 per 100 ml.

NOTE: Waters falling below these descriptions are considered as unsatisfactory and as Class E.
These standards do not apply to conditions brought about by natural causes.
For purpose of distinction as to use, waters used or proposed for public water supply shall be so designated.

Table 43

Historical Discharge Records
Discharges in cfs
Blackstone River & Tributaries

Blackstone River at Northbridge, Mass.

Water Year	Yearly Mean	August Mean
1951	267	92.8
1952	347	200
1953	324	103
1954	325	174
1955	408	1195
1956	400	83.1
1957	189	61.2
1958	320	150
1959	299	171
1960	371	161
1961	288	105
1962	250	107
1963	274	92.0
1964	-	84.6 (1)

24-yr. Average (1939-1963) = 246 cfs.
Maximum Discharge = 16,900 cfs (Aug. 20, 1955).
Minimum Discharge = 2 cfs (Aug. 29, 1941, Sept. 5, 1942, Aug. 28, 1957).

Blackstone River at Woonsocket, R. I.

Water Year	Yearly Mean	August Mean
1951	761	321
1952	933	270
1953	808	158
1954	816	255
1955	1090	2704
1956	1158	169
1957	531	121
1958	878	262
1959	768	310
1960	969	289
1961	852	204
1962	772	202
1963	778	158
1964	-	131 (1)

34-yr. Average (1929-1963) = 731 cfs.
Maximum Discharge = 32,900 cfs (Aug. 19, 1955).
Minimum Discharge = 21 cfs (Aug. 11, 1934).

Table 43 (cont.)

Historical Discharge Records
Discharge in cfs
Blackstone River Tributaries

	Water Year	Yearly Mean	August Mean
Branch River at Forestdale, R. I.			
	1951	171	61.1
	1952	205	44.8
	1953	178	31.4
	1954	182	47.9
	1955	224	372
	1956	250	32.3
	1957	122	21.4
	1958	193	46.3
	1959	164	49.4
	1960	200	47.7
	1961	185	37.5
	1962	159	34.8
	1963	149	23.4
	1964	-	21.3 (1)

23-yr. Average (1940-1963) = 165 cfs.
Maximum Discharge = 4240 cfs (Aug. 19, 1955).
Minimum Discharge _ 5.2 cfs (Oct. 7, 1948).

	Water Year	Yearly Mean	August Mean
Quinsigamond River at North Grafton, Mass.			
	1951	43.6	11.4
	1952	60.2	30.1
	1953	51.3	5.5
	1954	49.7	24.2
	1955	65.5	169
	1956	68.4	6.5
	1957	25.8	1.9
	1958	54.6	19.1
	1959	47.9	23.5
	1960	56.7	25.2
	1961	44.4	15.4
	1962	41.1	8.7
	1963	43.3	5.0
	1964	-	2.4 (1)

24-yr. Average (1939-1963) = 43 cfs.
Maximum Discharge = 820 cfs. (Aug. 20, 1955).
Minimum Discharge = 0.3 cfs (Oct. 14-17, 1942).

(1) Average flow for survey period of Aug. 2, 1964 through Aug. 21, 1964.

MR. STEIN: Thank you, Mr. Mackenthun.

Are there any comments or questions?

MR. LA RIVIERE: I would like to ask Mr. Mackenthun a question.

I believe in your introduction you stated that some of the information contained in the report was obtained from the Massachusetts and Rhode Island Departments of Health?

MR. MACKENTHUN: Yes, sir.

MR. LA RIVIERE: Well, then, for the purposes of the record, and for people who perhaps don't have time to read the whole report, I think due acknowledgment should be made in the summary of the cooperation of Massachusetts and Rhode Island in obtaining the information and submitting it and making it available to the Federal agencies.

MR. STEIN: Is that agreeable?

MR. MACKENTHUN: Yes.

MR. STEIN: Thank you.

MR. PELOQUIN: Mr. Mackenthun, I would like clarification of that one sentence or one paragraph where the sentence is omitted in the typing.

MR. MACKENTHUN: May I read that again?

MR. STEIN: Would you read the correct one?

MR. MACKENTHUN: I will read the correct one as it should appear. It is on Page 2 of the report. The fourth paragraph on that page should read as follows:

> "Of the total sewage discharged within the surveyed reach, 90,000 BPE, or 64 percent came from Worcester, Massachusetts, 45,000 BPE or 32 percent came from Woonsocket, Rhode Island, and 6,000 BPE or 4 percent from the other 10 smaller jurisdictions located along the river."

MR. PELOQUIN: Thank you.

MR. STEIN: Are there any further comments or questions?

(No response.)

MR. STEIN: I have just one minor one.

As I understood you, on the Ten Mile River, in the biological analyses you indicated it was polluted because there were only pollution-tolerant organisms there. You also said that in some cases even they weren't there because of probable toxicity.

Is that correct?

MR. MACKENTHUN: Yes, that is correct.

MR. STEIN: Now, maybe this will come out, or maybe it won't.

I don't know where the probable toxicity is coming from, but if we have a probable toxicity and you are killing off sludge worms, I guess no one cares very much; but if your assumptions are correct -- and, of course, we have not heard from the other parties here yet -- but if your assumptions are correct and desirable organisms should be found in that place after pollution is abated or remedial action is taken, and if toxicity is not taken care of, do you see a problem that this toxicity might begin to kill off desirable organisms?

MR. MACKENTHUN: That would be true.

I would assume that if pollution becomes abated in the area, the toxic constituents probably would be included in such an abatement, but there would be a problem, as I see it.

MR. STEIN: Yes, Mr. Shea.

MR. SHEA: Could I pursue that just a little further?

MR. MACKENTHUN: Yes.

MR. SHEA: Did you find any evidence of toxicity, or is this just an assumption that toxicity is there?

MR. MACKENTHUN: The evidence as it is presented in the report, is based on the findings of certain numbers of organisms at a particular point, and downstream from this location these very tolerant organisms were substantially reduced.

I am speaking here principally in this unnamed tributary just upstream from the State line on Ten Mile River. No organisms were found in the unnamed tributary itself. The physical habitat in the region surveyed was judged to be similar.

Therefore, one would not expect this reduction, except through some constituent that would be toxic to the population.

MR. SHEA: Did you identify any toxic substances?

MR. MACKENTHUN: No, sir.

MR. SHEA: All right.

MR. STEIN: Are there any further comments or questions?

(No response.)

MR. STEIN: If not, we will recess for ten minutes at this time.

Our present plans are to recess and reconvene promptly in ten minutes, and we plan to break for lunch at about twelve-thirty, or as near thereto as is convenient.

Thank you. We stand recessed for ten minutes.

(Whereupon a recess was had.)

MR. STEIN: May we reconvene, please?

Mr. Peloquin?

MR. PELOQUIN: As the Federal conferee, I am anxious that other Federal agencies have an opportunity to tell of their concern for pollution and clean water and the water uses that may be interested in. For this purpose the Regional Program Director has written and invited Federal agency representatives to attend this conference.

I believe we have with us today a representative from the Department of the Interior, from the United States Fish and Wildlife Service.

Is there a representative from that Department? Do you have a statement, sir?

MR. SCHRADER: Yes.

MR. PELOQUIN: Will you come up, please?

STATEMENT OF THOMAS A. SCHRADER, CHIEF, DIVISION OF TECHNICAL SERVICES, UNITED STATES BUREAU OF SPORT FISHERIES AND WILDLIFE, DEPARTMENT OF THE INTERIOR, BOSTON, MASSACHUSETTS

MR. SCHRADER: My name is Thomas A. Schrader. I am the Regional Chief of the Division of Technical Services in the Boston regional office of the Bureau of Sport Fisheries and Wildlife.

I have been asked by Mr. Mark Abelson, the Regional Coordinator for the Department of the Interior, to present an introductory statement which he prepared, and then I have a statement that has been prepared by our Bureau, which will be entered into the record.

Mr. Abelson's statement says:

> "The Department of the Interior, which is the principal Federal agency concerned with natural resources, has a definite interest in all waters of the country and in the entire pollution problem.
>
> "In order to coordinate the efforts of all those concerned with the related water problems, there must be comprehensive planning and activity among

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"all interests.

"The interest of the Department of the Interior in water can best be expressed by quoting from a recent statement by Secretary Udall before a congressional committee:

"'---the focus of Interior effort is directed to the maintenance of adequate national water supplies and adequate water quality for whatever uses man may wish to make of this valuable resource. The Interior approach emphasizes the coordination and interrelation between uses and the effect of these uses on management and quality of the total water supply system.'

"'Maintenance of water quality involves not only the quality levels for human consumption, but also quality levels for consumption by other animal and plant life, for development of other natural resources, and for industrial processes. These quality considerations are interrelated. They can be understood and controlled best from the point of view of water as a resource, rather than from the point of view of a particular quality need.'

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"In handling water problems over a period of years the Department has accumulated a great deal of experience. It has the facilities and the qualified manpower to deal with a wide variety of water problems.

"The Department has six operating Bureaus in this region, all of which have an interest in the region's water resources, ranging from purely unbiased fact finders to strong advocates of clean waters. These Bureaus are:

Bureau of Mines
Geological Survey
Bureau of Sport Fisheries and Wildlife
Bureau of Commercial Fisheries
Bureau of Outdoor Recreation

"Interior Bureaus carry on water quality studies related to the physical, chemical, and in some degree, biological adequacy of natural and developed water supplies. These studies and research are chiefly those in which the skills and required knowledge are based on geology, chemistry, hydrology, engineering and other physical science aspects of water management. Interior's water quality research extends to the study of environments adequate for the propagation, "production and control of both fish and wildlife resources, and for water based recreation.

"In common with many others, Interior has interests and responsibilities in the economic and social aspects of water-quality management. We recognize that such factors as quantitative requirements, competitive uses, and marketability of water and associated products must be given consideration in all plans. Interior takes account of the economic impact and other values that protection of water quality will have on the community, the basin, the state and the nation.

"A representative of one of the Interior Bureaus is here today and will present a statement concerning their interest in the waters of the Blackstone River Basin.

"The Bureau of Sport Fisheries and Wildlife will report on the effects of present water conditions on fisheries resources and for future fisheries potential in the basin."

That is the end of Mr. Abelson's statement. I will now read my statement into the record.

My name is Thomas A. Schrader. I am Regional Chief of the Division of Technical Services for the Bureau of Sport Fisheries and Wildlife with headquarters in Boston. The statement that I am to present represents the combined thinking of the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries.

We are pleased to have the opportunity to speak at this conference. The prospect of restoring the usefulness of the Blackstone River Basin and its tributaries is brighter now than it has been in many years. Throughout the nation people are saying, "Let's do something about pollution." We agree that now is the time to correlate and intensify all efforts to carry out realistic and effective pollution abatement programs.

The use of streams for waste disposal is a single-purpose use that we can no longer afford. Expanding populations demand that we make full use of our natural resources. Pollution deprives us of the opportunity for multiple use of our streams, lakes and estuaries. This fact is becoming recognized by more and more people every year, and corrective measures are being demanded by broad segments of the public.

Recreational needs are increasing at even a greater pace than our population. This situation is particularly acute in the Blackstone Basin, where the tide of urban expansion has virtually submerged traditional recreational areas. Fishing and hunting opportunities have been reduced by these changes, and it is clear that we must utilize each lake and stream to its maximum potential for production of fish and aquatic wildlife if we are to meet future human demands for hunting, fishing, and other recreational uses associated with these resources.

The anticipated demand can be shown by comparing the surface acres of fresh water now available to each person with what may be expected in years to come. According to the Outdoor Recreational Resources Review Commission report "Sport Fishing Today and Tomorrow," the area available to each resident in Massachusetts and Rhode Island in 1960 will be reduced by at least one-third by the year 2000. Moreover, it is expected that there will be three fishermen by the year 2000 for every angler in 1960. The number of fishermen will continue to increase at a proportionally faster rate than the general population.

Proper control of pollution would make possible full development of the fish and wildlife potential of many of our streams. The entire Blackstone Basin lies within easy reach of highly-populated urban areas. By the year 2000, we expect approximately 3,000,000 of the projected New England population of 17,000,000 people will fish. An estimated 800,000 hunters will live in the area by this date. We will be hard pressed to provide hunting and fishing opportunity for these people. Clean-up of the polluted areas would provide many thousands of man-days use for fishing. It would also help to more evenly distribute fishing pressure among the available waters. Feeding and nesting areas for waterfowl and other aquatic wildlife species would be enlarged and many additional man-days of hunting would be provided.

The potential for the Blackstone Basin for satisfying recreational demands is enormous. Based on data presented in the ORRRC report, it is estimated that the main stem Blackstone and Ten Mile Rivers could support at least 200,000 man-days of fishing by the year 2000. In addition, these streams could provide several thousand man-days of hunting each year.

The Blackstone is the largest and most northerly of the interior watersheds of the Narragansett Bay Basins. It has a total length of 49 miles and a drainage of 540 square miles. It has its origin in Worcester, Massachusetts, and flows generally southeast to empty into Narrangansett Bay at Providence, Rhode Island. The river is navigable and tidal for 4.7 miles below the dam at the highway bridge on U. S. Route 1, Pawtucket. A series of relatively short tributaries which include the Quinsigamond, Mumford, West, Branch, Mill and Ten Mile Rivers, enter the Blackstone along its course. The entire main stem of the river is polluted from municipal and industrial wastes. Many of the tributaries are also seriously affected by pollution.

The existing stream fisheries of the Blackstone Basin, both cold-and warm-water, are severely limited by poor water quality. The various lakes and ponds throughout the basin support largemouth bass, smallmouth bass, chain pickerel, brown bullhead, yellow perch, and white perch. Wallum Lake, near Douglas, Massachusetts, has been reclaimed, and provides suitable habitat for trout. Public lake fishing is maintained in several lakes and ponds within the Blackstone Basin.

The Quinsigamond River contains indigenous species such as chain pickerel, yellow perch, and brown bullhead. Although pollution in the form of domestic wastes does exist, a limited fishing is supported in sections of the stream.

The Mumford River has warm-water species in the upper reaches, but is heavily polluted from Uxbridge, Massachusetts, to its confluence with the Blackstone River.

The West River and its tributaries support trout, and these streams are stocked annually by the State. A study by the Massachusetts Division of Fisheries and Game during the early 1940's recorded about 5,000 man-days fishing per year on a segment of the West River. The best available estimate suggests that this stream now supports at least 10,000 man-days annually.

The Branch River is the largest tributary in the Blackstone Basin. Slatersville Reservoir, and the lower reaches of the river, support warm-water species of fish.

Mill River was formerly part of the Woonsocket Water Supply before the dam was washed out. Its major tributary, Peter River, has relatively good water in the upper segment, but becomes polluted in the vicinity of the Massachusetts-Rhode Island State line.

Ten Mile River has been stocked in several sections with trout. Also, warm-water species are present except in the lower reaches where pollution is moderate to severe.

Waterfowl and fur animals comprise a small segment of the basin's wildlife resources. Principal habitat for these species are wetlands such as marshes, swamps, and flooded timber lands. These interior wetlands are small and scattered, but possess high wildlife value. The bulk of waterfowl production comes from these inland areas rather than the larger coastal marshes. Even the smaller ones usually produce a brood of black ducks or wood ducks which, taken in the aggregate, amounts to a sizable total. Moreover, these interior wetlands offer an excellent potential for development and management.

T. A. Schrader

Oyster beds on the tidal flats at the mouth of the Blackstone River below Pawtucket supported substantial oyster harvests during the early 1900's. This area has long been closed to shellfish harvest because of pollution.

The Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries are vitally concerned with the various aspects of fish and wildlife conservation and development within the Blackstone Basin. Our concern reflects both the specific and general interest of the Congress in the conservation of the nation's fish and wildlife resources. The general policy of the Federal Government is expressed in these words quoted from the Fish and Wildlife Act of 1956:

> "The Congress hereby declares that the fish, shellfish, and wildlife resources of the Nation make a material contribution to our nation's economy and food supply, as well as a material contribution to the health, recreation, and well-being of our citizens; that such resources are a living renewable form of national wealth that is capable of being maintained and greatly increased with proper management; but equally capable of destruction if neglected or unwisely exploited; that such resources afford outdoor recreation throughout the Nation and provide employment, directly or indirectly, to a substantial

number of citizens.

The Fish and Wildlife Coordination Act authorizes this agency and the State Fish and Game Department to study effects of pollution in fish and wildlife resources and to recommend measures for alleviation of the problems. Our work on pollution is related specifically to fish and wildlife resources and is coordinated with the Public Health Service and other Federal, State, and local agencies interested in water use.

Historically, great runs of anadromous fishes utilized tributaries flowing into Narragansett Bay. Pollution and dams have completely eliminated these runs up the Blackstone and Pawtucket Rivers. The Blackstone, for example, once supported runs of American shad and Atlantic salmon, the latter species moving upstream as far as "The Falls" at Pawtucket, Rhode Island. Conditions along the Taunton River still permit passage of substantial numbers of alewives each spring. The Palmer River, a smaller tributary entering Narragansett Bay from the east, still supports a shad run, while the presence of sea-run brook trout is reported in some of the smaller tributaries that enter the Bay. In recent years there has been a growing interest in the restoration of anadromous species throughout the Northeast. The recent impetus for anadromous fish restoration along the coast has emphasized the need for careful consideration of fishways for existing and future water control and impoundment structures.

Fishways, fish stocking, or other tools of management are of little significance, however, unless the quality of water is improved to meet the biological requirements of fish and wildlife native to the Blackstone Basin. We offer our cooperation to the fullest of our capabilities in support of such a water-quality-improvement program.

Thank you very much.

MR. STEIN: Thank you, Mr. Schrader, for a very complete statement, and thank Mr. Abelson for us.

Are there any questions or comments? Mr. Taylor?

MR. TAYLOR: Mr. Schrader, this isn't in the form of argument in any way, shape or manner, but may I ask: When you speak of the restoration of the cold-water fisheries, do you speak of it in the upland reaches, or nearer the sources of the Blackstone River?

Are we speaking of including this kind of a fishery in our water supplies, which are generally received from the upland waters, rather than the lower uses of the stream, where we have industrial waste?

MR. SCHRADER: Well, this would be a program of the State Game and Fish Department, if they were interested in developing a fishery in water supply reservoirs.

This is a controversial matter. I believe that many State Public Health agencies or local organizations object to fishing in the drink.

I happen to be one who believes that you can do this safely I did not mean to imply in this paper that we are proposing a program on a restoration of fish in the water supply reservoirs.

I merely point out that with pollution abated, the upper reaches of the stream, which are cold, would support cold-water fisheries if the pollution is abated. As it is abated, I think this will extend downstream somewhat from where the cold-water fisheries now occur, and if it is abated the warm-water fisheries will take over in the lower reaches of the stream.

MR. TAYLOR: It has just been my opinion on the matter that the cold-water fisheries potential extended only into the unpolluted areas now, that are currently unpolluted.

MR. SCHRADER: I think that is correct. At present the only cold-water fisheries are in the upper limits that are not polluted.

MR. TAYLOR: Might I ask, is there any program, in which your Department or otherwise intends to do something about the dam situation? There are many dams in this river. I believe none of them have fishways, or fish ladders.

Is there any program that has been advanced or suggested that would in any way help in this situation?

MR. SCHRADER: The anadromous fish restoration program, which I mentioned in my prepared paper, has as yet not received favorable action by the United States Congress.

There is considerable interest in the legislation on the part of some congressmen. They are actively engaged in encouraging the passing of this legislation.

If this legislation is enacted, one of the things that it will provide is the legislative authority, and presumably appropriations -- there will be authorization in the legislation, and the appropriations would hopefully be forthcoming to construct necessary passage devices.

One other thing that has been going on without the anadromous fish legislation is that many of the dams -- and I am not familiar enough with your question to know whether any of these situations occur in this river -- but many of these dams on these Northeast coastal streams are power dams, and under a recent program of the Federal Power Commission, they have been putting pressure on the owners of these dams to secure licenses from the Federal Power Commission. As these companies have complied with this requirement and requested licenses, their applications are referred to the Fish and Wildlife Service for consideration.

One of the things that we are uniformly recommending for incorporation in the license to be issued to these companies is a provision that will make it possible for the Federal agencies, after a hearing -- we are not proposing to be unfair -- but after consideration at a hearing, if the pollution has been abated in these streams to the extent that they will support anadromous fish runs, we can require the companies to construct the necessary fish passage facilities.

This stipulation has been incorporated in a number of licenses that have been issued during the past two years.

MR. TAYLOR: There is only one other question that I would like to ask, and I don't know if you are in a position to know the answer. This has to do with the Bureau of Mines, which is in your general parent organization.

I understand that the Bureau of Mines has the responsibility of studying methods of treating acid iron wastes. Has that Bureau come up with a method that they would recommend and feel is economically feasible at this time?

MR. SCHRADER: I can't say. I know they have been working on it, but what the results have been I am not familiar with.

MR. TAYLOR: Thank you.

MR. STEIN: Are there any further questions at this time?

MR. PELOQUIN: I think Mr. Schrader's answers to Mr. Taylor took care of the questions that I had also.

MR. STEIN: I wonder, Mr. Schrader, for the benefit of the audience, if you can indicate what an anadromous fish is?

MR. SCHRADER: Oh, this is one of the faults of people who become involved in a profession. They think everybody knows the lingo of their profession.

Anadromous fish are fish which spend part of their life in fresh water and part of their life in the ocean. The most commonly known species along this area, I presume, is the shad, which spends its life in the ocean, but moves upstream into the fresh water streams to spawn, and then returns to the ocean.

The principal place that people are interested in in this restoration program on the Northeast scene is the Atlantic Sound, which at one time was probably as abundant as the Pacific Coast salmon relatively.

Now, there weren't as many of them because there weren't as many streams, but there at one time were very substantial Atlantic Sound runs from the coast rivers. They have been wiped out, except for a very small run into a few streams in Maine, and some fairly substantial remaining runs in the Canadian streams.

MR. TAYLOR: The species that we know around here and all of these people are familiar with particularly are the alewives.

MR. SCHRADER: I was going to mention the alewife.

Then we have another species known as catadromous fish, and I am sure you all know the eel, which moves up the streams in this area. It has a reverse process. It spends its adult life in fresh water streams, but moves into the ocean to spawn. There is interest in restoring the eel in some streams along the coast.

MR. STEIN: Thank you, Mr. Schrader.

I might make one comment here. This is a problem in protecting and restoring anadromous fish that we find particularly in two areas of the country, in the Pacific Northwest and in the New England States.

In the Pacific Northwest, there is a never-ending struggle to be sure that the salmon keep coming back.

As you can appreciate, I think it is fairly well agreed that there are two problems in the depleting anadromous runs, and I might say the Atlantic salmon have been all but depleted here. If you recognize the kind of commercial and sport resource salmon fishing is on the West Coast, you would recognize the advantage of having that kind of fishing and the economic value it would bring to an area.

However, the two things that keep the anadromous fish out of the rivers are pollution blocks, where the fish can't get through, and dams. Either one of them provides an effective block.

If there isn't a suitable environment for the fish to go through and he can't make it through that pollution block, he can't get upstream. If you have a wall in front of the fish, he just can't get over that wall without a little help.

We in the Federal Government I think are now recognizing the value, if possible, of restoring the Atlantic salmon and other anadromous fish to the New England area. We have full cooperation with the Department of the Interior, particularly the Fish and Wildlife Service, who are interested in the fish, know the habits, know the stocking, and would be able to devise methods of restoring these fish up these rivers if a program could be started for us to try to achieve with the State and the interstate agencies the abatement of pollution.

We have also very recently had a lot of interest by the Federal Power Commission, which, as Mr. Schrader has pointed out, has tried to put pressure on a lot of these power dams to put in fish passage devices.

Also, during the 1920's, a load of these dams were put in and given permits. There was a lot of argument at that time as to the effect these dams would have on the streams, and the compromise was reached that they will be given a fifty-year permit.

Many of these permits, as you can appreciate, are going to be up for renewal, or are coming up in the seventies, and the Federal Power Commission is alerted to this kind of operation.

I would like to say one more thing for your agency. The Fish and Wildlife Service has demonstrated that it has been able to restore salmon runs in streams in the Pacific Northwest, where these salmon runs had once been wiped out either by dams, or pollution, or both.

When these streams were restored and the water quality was restored so the fish could get through, and appropriate fish passage devices were supplied -- I don't want to get too much into the details, but evidently they bring salmon up there and the salmon are so smart they keep coming back.

I hope I am not oversimplifying it. The Fish and

Wildlife Service is convinced that if these streams can be made available and given the proper habitat, with their new-found techniques they can restore these anadromous runs.

MR. SCHRADER: Thanks a lot for selling our program. You did a fine job for us.

MR. STEIN: I just wanted to explain it.

Mr. Peloquin?

MR. PELOQUIN: Thank you, Mr. Schrader.

Other agencies have not indicated whether or not they would like to present a statement.

We do have with us from the Department of Commerce Mr. Clifton C. Johnson, the Field Coordinator for the Area Redevelopment Administration.

Do you have any comments or statement, Mr. Johnson? Is he still here?

(No response.)

MR. PELOQUIN: We also did have with us earlier Cdr. W. N. Derby, Jr., of the Intelligence and Law Enforcement Branch of the First Coast Guard District, and Lt. Cdr. L. J. Hoch, Legal Officer for the First Coast Guard District.

Are these gentlemen still here?

(No response.)

MR. PELOQUIN: Do we have a representative from the Department of Agriculture?

(No response.)

MR. PELOQUIN: Do we have a representative from the Federal Power Commission?

(No response.)

MR. PELOQUIN: Do we have a representative from the United States Air Force?

(No response.)

MR. PELOQUIN: The Air Force, I understand, has responsibility for an industrial plant located in the basin. Consequently, we did extend an invitation to them. However, their wastes are adequately treated and do not present a problem.

MR. STEIN: Do you want to name the base for the record?

MR. PELOQUIN: I will have to rely on Mrs. Smith for that.

Mrs. Smith, will you give us that information, the Air Force industrial plant in the basin?

MRS. MILDRED SMITH: The Lyman Ordnance Plant in North Rapids.

MR. PELOQUIN: Thank you.

MRS. SMITH: They have completed secondary treatment.

MR. PELOQUIN: That is Mrs. Mildred E. Smith, Basic

Data Engineer.

Also here from the First Naval District is Mr. Earle King, the Sanitary Engineer for the District Public Works Office.

Mr. King, do you have a comment?

MR. KING: No.

MR. PELOQUIN: We also have Mr. James Lambie, representing the New England Division Corps of Engineers.

Mr. Lambie, I understand you have a statement?

MR. LAMBIE: I have no statement.

MR. PELOQUIN: You have no statement?

MR. LAMBIE: I have no statement.

MR. PELOQUIN: Thank you.

Mr. Chairman, this concludes the list of Federal agencies who had been invited.

Are there any other Federal officials who would like to present a statement?

MR. JENSEN: I would like to present a further statement on behalf of the Public Health Service, if I may.

MR. PELOQUIN: Would you come up to the lectern, please?

STATEMENT OF EUGENE JENSEN, CHIEF, SHELLFISH SANITATION BRANCH, DIVISION OF ENVIRONMENTAL ENGINEERING AND FOOD PROTECTION, BUREAU OF STATE SERVICES, PUBLIC HEALTH SERVICE, UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, WASHINGTON, D. C.

MR. JENSEN: I am Eugene Jensen. I am Chief of the Shellfish Sanitation Branch of the United States Public Health Service.

I apologize if the record might show some overlap between the statements delivered before and mine. We do have a mutual interest in shellfish sanitation and the uses of shellfish in the country.

My statement of interest in the conference on interstate pollution of the Blackstone River is made within the framework of the National Shellfish Sanitation Program -- a consumer-protection-oriented program administered jointly by the States and the United States Public Health Service.

We are directly interested in the pollution profiles of the Blackstone and Ten Mile Rivers. Both reach the Providence River which discharges into the upper reaches of

Narragansett Bay. It is a logical proposition that the water quality levels in these two rivers determine, in part, the sanitary quality of the water overlying the shellfish beds in the Providence River and the upper portion of Narragansett Bay. The water quality of these two areas determines the sanitary quality of shellfish which may grow in these areas. It follows then that the water quality of the Blackstone and Ten Mile Rivers will determine, in part, the sanitary quality of shellfish in these two areas -- shellfish which may be shipped in interstate commerce. As part of my statement I want to document the historical relationship between water pollution and shellfish.

Technical Considerations:

Oysters, clams, and mussels have an unusual potential for the transmission of disease to man. This unusual potential can be attributed to three factors:

(1) The environmental growth tolerances of shellfish are such that they ordinarily grow only in estuaries in which there is an admixture of fresh and salt water. These are also areas most subject to pollution with both industrial and municipal wastes.

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(2) Shellfish are filter feeders. In the process of feeding they pump large quantities of water across their gill systems. Particulate material and dissolved substances are removed and concentrated to levels above that of the overlying waters. Quahogs during period of active feeding concentrate bacteria to a level 2.5 to 6.0 times that of the overlying water. The concentration factor for metals, industrial wastes or pesticides is much greater.

(3) Shellfish are frequently consumed raw or with little cooking. The entire animal is eaten.

It has been demonstrated many times that these factors can combine to transmit human illness. Typhoid fever has been historically linked with polluted shellfish, but in recent years infectious hepatitis has been the prime offender. There have been no recognized instances in the United States in which shellfish have carried a sufficient burden of industrial wastes to cause acute illness. However, in Japan in the past several years, some 83 cases of severe mercury poisoning were attributed to waste discharged from a plastics manufacturing plant. Carcinogens and pesticides have also been identified in shellfish.

Use of shellfish as food then demands that great care be exercised to assure that harvest or culture areas are reasonably free of undesirable pollutants. By similar reasoning, great care must be exercised to prevent the harvesting of shellfish for direct marketing from any areas which are not of satisfactory quality. These two elements are, in fact, the underlying principles of the National Shellfish Sanitation Program.

Historical Considerations:

The National Shellfish Sanitation Program was initiated in 1925. This action was taken in the wake of a major outbreak of typhoid fever attributed to oysters. Two public forces were in action. On the one hand, the protection of the public health demanded action to prevent the continued transmission of preventable disease through a food product. On the other hand, the shellfish industry recognized that they could not sell their product unless public confidence could be restored and maintained. These two forces, acting in concert, resulted in the appointment of a special advisory committee to the Public Health Service to determine if these plural goals were compatible and to recommend corrective action.

The special committee concluded that this was possible and recommended establishment of a coordinated national program with primary administrative authority vested with the States. This program, initiated in 1925, is still in effect. The State of Rhode Island and Providence Plantations is a participant in this program and their sanitary control measures are currently endorsed by the Public Health Service as meeting the sanitation standards of the National Shellfish Sanitation Program.[1]

Shellfish as a Natural Resource:

The estuaries and their biological populations have long been recognized as a valuable natural resource. In fact, colonial statutes hopefully designed to assure the wise use of this resource antedate most other conservation measures in the United States. Unfortunately, this concept passed into a period of eclipse -- at least insofar as water quality was concerned -- during the very period in which degradation of estuarine water quality was most prevalent. It now shows signs of emerging.

The National Shellfish Sanitation Program as established in 1925 had a twofold base: (1) Safe use of a resource, and (2) conservation of a resource. This dual concept was reaffirmed by action taken at the 1964 National Shellfish Sanitation Workshop which adopted a positive statement to the effect that the estuaries represented a valuable manageable natural resource -- similar in many respects to forests, land, air, or fresh water -- and that shellfish culture represented a beneficial use of this resource. It does not, of course, follow that shellfish culture is the only beneficial use, or that it is the most important beneficial use. But clearly, and for several hundred years of our history, shellfish culture has represented a beneficial use of a natural resource -- the estuary and its tributary streams.

In general terms this suitability of an estuary for shellfish growth to be harvested for food use can be readily shown in a 3 x 2 table.

	Microbiological Contaminants	Chemical Contaminants	Physical-Chemical Environmental Changes
Normal Reproduction and Growth	Least	Equal	Most
Suitability as human food	Most	Equal	Least

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The quality of water in an estuary is the algebraic sum of the qualities and quantities of the input fresh and salt water giving due weight to relative effects of the conservative versus non-conservative "pollutants." This is not the time or place to elaborate on all factors which enter into this equation. However, in terms of the fresh water input, these elements include such factors as:

(1) Total pollution added to stream with consideration for variables such as intermittent degrees of treatment or to sewage by-pass during period of storm.

(2) Decay rate of pollutant.

(3) Time of transport from pollution source to estuarine shellfish area. During storm periods -- when overflows may take place from combined sewers -- the time of transport may be lowest.

(4) Technical feature of sewerage system such as automatic overflows or combined sewers. For example, during storm flow as much as 95% of the sewage may by-pass a treatment plant. On an annual basis this might amount to only 3-5%, but shellfish are not eaten on an annual basis. They represent the quality of the water at the time of harvest --

assuming environmental conditions are suitable for their activity.

(5) Physical characteristics of the estuary and tidal influence which determine relative proportion of salt and fresh water, e.g. salinity and the dilution and transport of contaminants.

Affected Shellfish Areas:

How do these factors apply to the Blackstone and Ten Mile Rivers and the downstream estuarine area of the Providence River and Upper Narragansett Bay? What are the current values of these areas? As a prologue to the future what was their past value as shellfish-growing areas? The report of the Division of Water Supply and Pollution Control does not consider these factors nor does it analyze the influence of these two river systems in terms of the preceding 3 x 2 table for the receiving estuarine areas.

Three areas are considered here: Upper Narragansett Bay (Ohio Ledge), Providence River, and Seekonk River.

Upper Narragansett Bay (Ohio Ledge). The upper bay is a "conditionally approved" shellfish area.[1] Direct marketing of shellfish from the upper bay is dependent upon the attainment of established performances and degree of treatment at the various sewage treatment plants on the adjoining waters and in the river basins above the designated closure line. In order for continued use of the upper bay as a source of shellfish for direct marketing it will be necessary to continually prevent any additional pollution from reaching this productive area and to strive for further pollution abatement.

In connection with hurricane studies of Narragansett Bay, the population of hard clams ("quahaugs," Mercenaria mercenaria) in the upper bay was estimated in 1956 to be 195,562,000 (number of clams).[2] The following table shows how this area compares in its contribution with the other major adjacent approved shellfish areas.

Table 1. Number of Clams in Certain Areas of Narragansett Bay and Adjoining Waters.[2]

Upper Narragansett Bay	195,562,000	(650,000 bush.)*
East Passage	56,217,000	(188,000 ")
Bristol Harbor	65,898,000	(220,000 ")
High Banks	67,619,000	(225,000 ")
Greenwich Bay	30,062,000	(100,000 ")

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(Note: See Figure 2 for location chart. In the reference report Upper Narragansett Bay is called "Ohio Ledge." The Bristol Harbor value includes portion of closed area.)

* Assume 300 clams/bu., mixed sizes.

Providence River. The "Polluted Shellfish Area" description for Providence River is as follows: [2a]

> "The Providence River and Upper Narragansett Bay, north and west of a line from the Rhode Island Department of Health range marker on the shore at Conimicut Point to Conimicut Light thence to Old Tower at Nayatt Point including the tributaries of these waters north and west of this line."

Commercially harvestable beds of quahaugs now exist from the mouth of the river up to Sabin Point. The lack of shellfish beds further upriver was noted in a United States Fish and Wildlife Service report: "The area above Sabin Point is almost completely barren."[2] The bottom sediments in the head reaches of the Providence River are now black and "oily." These and other conditions undoubtedly are causes of the barren bottom condition. More recent information bearing on the value of this presently closed polluted area is given in the report by the Rhode Island Shellfish Advisory Committee:

> "The shellfish resource in existing contaminated areas is very great indeed. Competent observers have estimated there is a standing crop of 600,000 -- 800,000 bushels of clams in the Providence River alone."[3]

This area has been used as a source of shellfish for transplanting operations and recent records on transplant quantities are:

1962	22,417 bu.
1963	36,275 "
1964	42,537 "

During the period of less than ten years ago to date, sea mussels (Mytilus edulis) have been sufficiently abundant to foul water intake pipes of Narragansett Electric Company (above Fox Point, near Point Street Bridge).

Historical records reveal that harvesting of oysters in the Providence River dates back at least to the Colonial Period.[4] Decline of the oyster industry in Rhode Island waters occurred during the early 1900's, concomitant with a similar decline in other nearby waters, especially New

England estuaries emptying into Long Island Sound, and Raritan Bay, New Jersey.[5]

> "As long ago as 1918, P. Mitchell (R. I. Comm. of Inland Fisheries, Pp. 35-) reported that 'There has been a lack of oyster sets in Rhode Island for the past four or five years.....All observations in the main portions of the bay show the conspicuous failure of oyster propagation.....It is reported by persons familiar with the region that natural oysters were once fairly abundant in the Seekonk River and the upper part of the Providence River. That none are to be found there now seems to be the general testimony.....One can readily imagine that if the Seekonk River and the upper part of the Providence River were well populated with good spawn producing oysters, the June spawn production might be enough to yield a satisfactory set over the larger part of the entire Bay.'"

The factors most often presumed to have been responsible for this decline, but not in order of their effect, are: Pollution, including sedimentation; failure to repopulate; predators; and during the latter years of the decline, hurricanes. The impact of this loss of this "nursery area" on the oyster industry of the entire State may have been significant. As late as 1912, 21,236 acres of land were leased by the State to oyster production. As late as 1935 the State produced about 5.25 million pounds of oysters, although this was based on seed imported from neighboring States.

Seekonk River. The Seekonk was once productive of oysters and may have been a significant factor in maintaining a natural population of oysters throughout Narragansett Bay. Although present hydrographic aspects of environmental conditions indicate that this area has a potential for shellfish production,[6] information indicating the reasons for absence of shellfish is not known. It is surmised that contaminants and the soft bottom may be prime negative factors.

Relationship of Blackstone and Ten Mile Rivers to Estuarine System:

What are the factors which determine the suitability of the Seekonk and Providence Rivers for shellfish culture? It is evident that the Blackstone and Ten Mile Rivers in question are not the sole factor nor are they necessarily even a major factor -- but inescapably they are factors in establishing the pollution profile in these two estuarine areas. Since this conference deals with the Blackstone and Ten Mile

Rivers I do not believe that it is encumbent upon the National Shellfish Sanitation Program to establish the relative importance of pollution sources in these two river systems as against other sources of pollution.

An analysis made by the Rhode Island State Department of Health estimates high flow runoff from the Blackstone at 780 MGD, as compared with a total of 1400 MGD reaching the estuary.

Table 2

Source	Drainage Area-Mi^2	Runoff MGD/Mi^2	Runoff MGD
Blackstone R.	487.9	1.60	780
Woonasquatucket R.	55.5	1.67	93
Moshassuck R.	11.5	1.67	19
Pawtuxet R.	237.2	2.07	492
Coast	10.0	1.67	17
	802.9		1401

The accuracy of this analysis is confirmed by United States Geological Survey records.[7] Conservative pollutants discharged to the Blackstone or Ten Mile would reach the Seekonk and Providence Rivers. For example, alkyl-benzene sulfonate levels of 0.58 were recorded in the Blackstone River 1.8 miles above the Seekonk. This compares with a drinking water standard of 0.50 mg/1. Woelke, Washington Fish and Game, has demonstrated that 1.0 mg/1 is toxic to bivalve larvae. The relationship betweel alkyl-benzene sulfonate and other conservative pollutants is not established; however, Drinking Water Standards state:

> "Concentration of Alkyl benzene sulfonate above 0.5 mg/1 are also indicative of questionable levels of otner sewage pollution."

A recent study of certain chemical contaminants in hard clams from the Providence River, off Bullock Point, revealed that these shellfish had up to five times the levels of copper, chromium, and nickel than hard clams from other Rhode Island waters (Table 3).

Table 3. Contaminants in Hard Clams. (reported as mgms/kg of wet, drained clam tissues)

	Copper	Chromium	Nickel
Bullocks Point*	17.9	1.0	1.0
Allens Harbor, Charleston Pond & Narragansett Bay at South Ferry**	0-5.0	0-0.2	0-0.2

* -- Based upon analysis on 720 grams of clam tissue.

** -- Reference stations: analyses were made on over 600 clams harvested during the period July-December 1964.

The Rhode Island Department of Public Health has completed an analysis of bacterial pollution in the tributaries of the Providence and Seekonk Rivers.

Table 4. Analysis Pollution Sources - Upper Narragansett Bay

Source	Population Equivalent	Distance To Open Area (Miles)	Flushing Time (Days)	Calculated % Reduction	Population Equivalent To Open Area
Blackstone R.	590	11.6	3.29	98.06	11.8
Blackstone Valley STP*	344	9.73	3.29	98.06	6.68

* -- Sewage Treatment Plant

Sewage Plant	Population	Flow	Type
Blackstone Valley	101,260	14.5 MGD	Primary & Cl_2
Providence	226,360	42.3 MGD	Secondary & Cl_2
East Providence	31,000	2.9 MGD	Secondary & Cl_2

E. Jensen

Flushing times in this analysis were calculated on the basis of a simple tidal prism. Studies by Hicks, University of Rhode Island, and by the Public Health Service Northeast Shellfish Sanitation Research Center on a comparable estuary suggest that this may be a conservative estimate and that the time of flushing may be underestimated and that actually a longer flow time prevails. On the basis of this analysis non-conservative pollutants are a measurable, although not dominant, factor in determining the sanitary quality of Upper Bay.

The effect is more direct on the Providence and Seekonk Rivers. United States Coast and Geodetic Survey Tidal Current Charts for Narragansett Bay (1963) indicate that a tidal transports from the head of the Seekonk to the Providence River in a single tidal cycle of five hours.

During periods of higher river flow, when time of transport is decreased, the Blackstone would have a greater impact on both areas. By-passing due to storm flow would have a similar effect.

The effect of the Ten Mile River is predictably less because of its relatively present low rate of discharge into the Seekonk.

Conclusions:

E. Jensen

1. Sewage and industrial wastes discharged to the interstate waters of the Blackstone and Ten Mile Rivers determine, in part, the suitability of the Seekonk and Providence Rivers and the Upper Narragansett Bay for the harvesting of shellfish used for food, and is a minor contributory factor in determining the present "Polluted Area" classification of the Seekonk and Providence Rivers.

2. Industrial wastes discharged into the interstate waters of the Blackstone and Ten Mile Rivers is a probable factor in preventing the re-establishment of an oyster population in the Providence and Seekonk Rivers, and may thereby be a contributing factor to the decline of the oyster population in other portions of Narragansett Bay.

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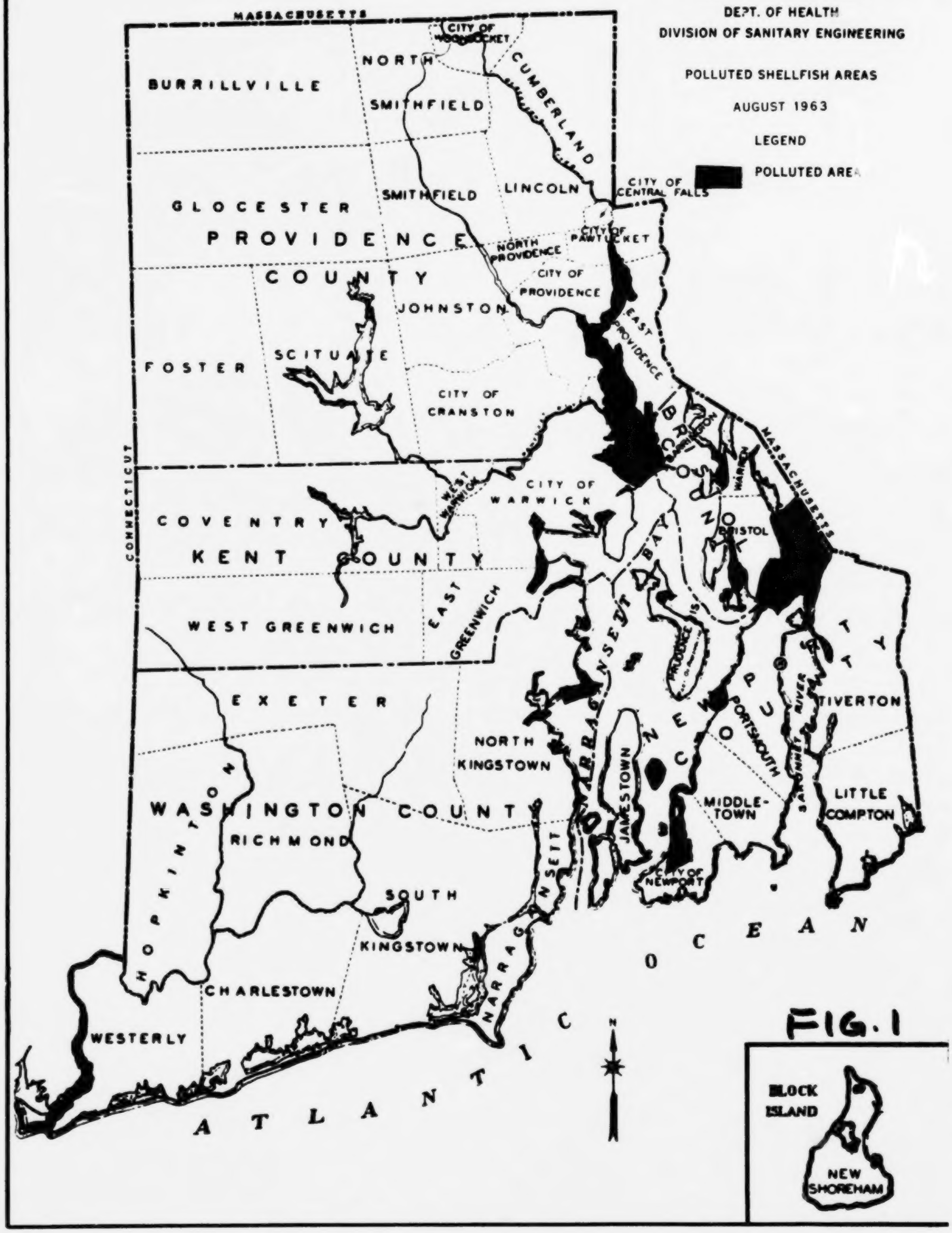

MASSACHUSETTS
CITY OF WOONSOCKET
NORTH SMITHFIELD
BURRILLVILLE
CUMBERLAND
SMITHFIELD
LINCOLN
CITY OF CENTRAL FALLS
GLOCESTER
PROVIDENCE COUNTY
NORTH PROVIDENCE
CITY OF PAWTUCKET
CITY OF PROVIDENCE
JOHNSTON
EAST PROVIDENCE
FOSTER
SCITUATE
CITY OF CRANSTON
CONNECTICUT
BRISTOL COUNTY
BARRINGTON
WARREN
MASSACHUSETTS
WEST WARWICK
CITY OF WARWICK
COVENTRY
KENT COUNTY
BRISTOL
EAST GREENWICH
WEST GREENWICH
NARRAGANSETT BAY
PRUDENCE IS.
NEWPORT COUNTY
EXETER
PORTSMOUTH
SAKONNET RIVER
TIVERTON
NORTH KINGSTOWN
JAMESTOWN
WASHINGTON COUNTY
MIDDLETOWN
LITTLE COMPTON
HOPKINTON
RICHMOND
CITY OF NEWPORT
NARRAGANSETT
SOUTH KINGSTOWN
OCEAN
CHARLESTOWN
WESTERLY
ATLANTIC
N
BLOCK ISLAND
NEW SHOREHAM

STATE OF RHODE ISLAND
DEPT. OF HEALTH
DIVISION OF SANITARY ENGINEERING

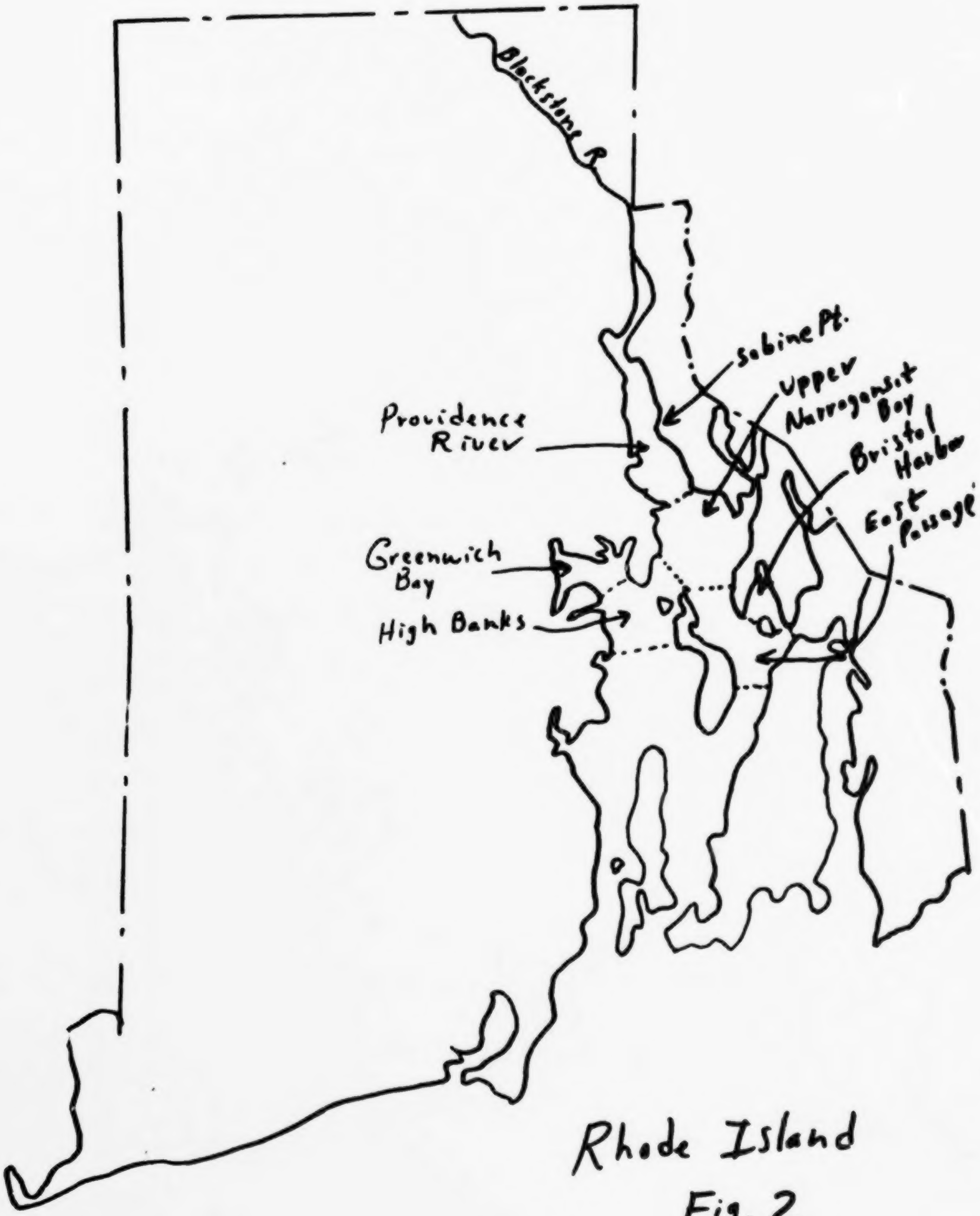
POLLUTED SHELLFISH AREAS

AUGUST 1963

LEGEND

■ POLLUTED AREA

FIG. 1


Blackstone R.
Sabine Pt.
Upper Narragansett Bay
Providence River
Bristol Harbor
East Passage
Greenwich Bay
High Banks

Rhode Island
Fig. 2

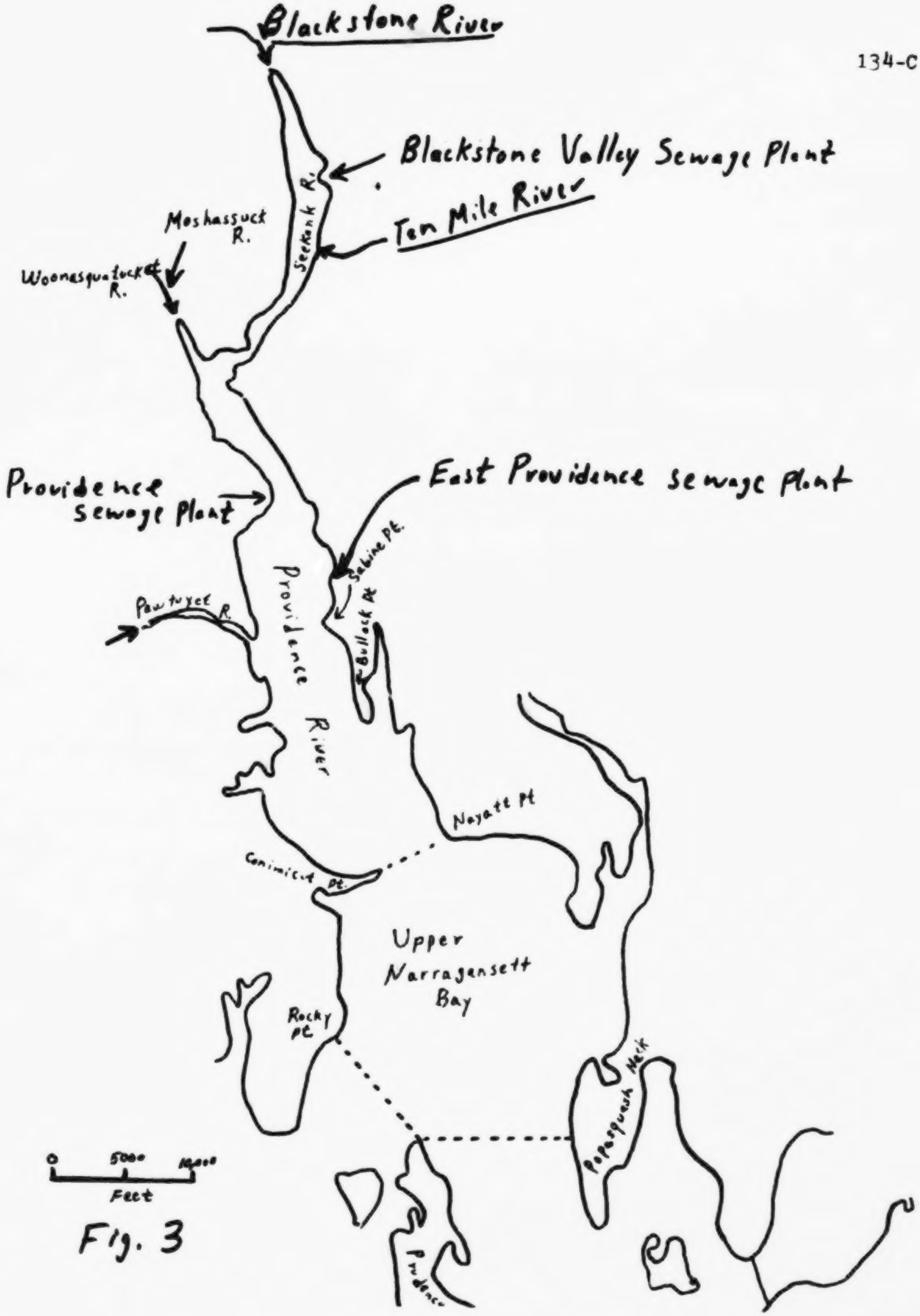

Blackstone River
Blackstone Valley Sewage Plant
Ten Mile River
Moshassuck R.
Woonasquatucket R.
Seekonk R.
Providence Sewage Plant
East Providence sewage plant
Sabine Pt.
Bullock Pt
Pawtuxet R.
Providence River
Nayatt Pt
Conimicut Pt.
Upper Narragansett Bay
Rocky Pt.
Popasquash Neck
Prudence
0
5000
10000
Feet

Fig. 3

MR. STEIN: Thank you, Mr. Jensen.

Are there any comments or questions? Mr. Taylor?

MR. TAYLOR: Mr. Jensen, you speak of ABS levels and ABS as being one of the factors that I believe you are indicating may have an effect on the re-establishment of the shellfish industry or the shellfish population.

I would only like to point out that neither the State nor the interstate agency has any jurisdiction over this matter of ABS. This is a matter that we cannot control then at the present time.

I just wanted this in the record, that this is nothing that we can do much about.

MR. JENSEN: We might further observe that the trend is away from the use of detergents of this kind.

MR. TAYLOR: That is strictly correct, but as a State agency or an interstate agency, we cannot operate in contradiction to interstate commerce, which is the factor as to whether or not ABS detergents are permitted or sold in our areas.

MR. STEIN: With this in the record, let me say this: I don't know that a State or interstate agency in our society can effectively control ABS or detergent foam, but I would not want to say that you don't have jurisdiction.

Wisconsin passed a law. I don't know how well this can work.

We in the Federal Government don't want to assume extra jurisdiction. I don't know that this has any particular place for the record, but I did want to indicate that at least some of the State people think theoretically that they have jurisdiction.

I would agree with you, that, as we have soap advertising or detergent advertising on TV, with it being brought in with the brand names in interstate commerce, that the likelihood of effective local control is remote, but I think theoretically both of our dear friends in the State would argue that question of jurisdiction.

I just wanted the record to show that.

Are there any further questions?

(No response.)

MR. STEIN: If not, we will stand recessed for lunch.

The snack bar and the restaurant are on the second floor. We will reconvene promptly in an hour and a half, two o'clock.

(Whereupon, at 12:30 p.m., the conference was recessed until 2:00 p.m. of the same day.)

AFTERNOON SESSION

(2:00 p.m.)

MR. STEIN: May we reconvene?

Mr. Peloquin, do you have any more people?

MR. PELOQUIN: Are there any other Federal agency representatives who would like to make a statement at this time?

(No response.)

MR. PELOQUIN: I think we have it all, Mr. Stein.

MR. STEIN: Thank you. That seems to complete the Federal Government's statement.

We will now call on Mr. La Riviere of the New England Interstate Water Pollution Control Commission.

MR. LA RIVIERE: Mr. Chairman, members of the conference, ladies and gentlemen:

First of all, I would like to introduce the members of our Commission, the New England Interstate Water Pollution Control Commission.

The Chairman of our Commission is Mr. Bryant Hopkins from Maine; Mr. William J. Ferrara from Massachusetts, and Mr. Charles E. Gauthier of Rhode Island.

At this time I would like to call on our Chairman, Mr. Bryant Hopkins, who wishes to present a statement.

STATEMENT OF BRYANT L. HOPKINS, CHAIRMAN, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION

MR. HOPKINS: Mr. Chairman and gentlemen:

I believe this is the fourth enforcement conference that has been called in the New England area.

At all of the previous conferences, our Executive Secretary has appeared, or some member of our Executive Committee or officer, and presented our statement. Generally, I think our Executive Secretary has appeared.

Since the last conference, we have had a new Executive Secretary of our Commission, who has just appeared before you, and our retiring Secretary, Mr. Knox, is here in the room.

Of course, Mr. Knox has made the great contribution to the pollution problems of New England, and also nationally.

I am sure it is the wish of our Commission that Mr. LaRiviere make contact with all the people in the New England area who are interested in water improvement on the interstate streams.

I think that there is little I should say. Of course, I can't speak for the Commission anyway, because we have not had the report before us.

I will make two suggestions: These, of course, are personal suggestions.

I believe that all of the agencies, State, interstate and other persons interested in water improvement on the interstate waterways of New England, believe in the full exchange of information, and we have enjoyed that full exchange of information.

I would suggest that in the future these position reports be prepared early enough so that we might have them before the second stage of these conferences.

I believe about three weeks ago, the first stage of this conference was held, at which time the people representing the State agencies and the Federal agency and our agency met and tried to determine areas of agreement.

The only other conference I have had the pleasure to attend was the conference in Portland, and at that time our Chairman gave our position statement, and he also spoke informally and gave us some very interesting thoughts, I am sure.

I read with a great deal of interest the publicity that came from that conference. I think that the people of New England, all the people of New England, especially on these interstate waterways, are tremendously interested in the problem, and they like to know what is being done. They like to have accurate publicity on these conferences.

It must be obvious to you and to anybody else that no newspaper reporter, no matter how objective his intent, could possibly report a conference of this sort without guidance from the persons connected with the agencies.

As a second suggestion, I would like to have you consider that in the newspaper publicity coming from these conferences, the newspaper reporters be assisted by those representing the State agencies and our agency.

The people themselves cannot take time to read extensive reports, or to understand the many facets of this business. If they are going to be informed at all, they have to be informed by brief and very carefully prepared information, and I think the agencies themselves have to get together and help direct that publicity.

The preamble of the New England Interstate Water Pollution Control Compact states, and I quote:

> "The abatement of existing pollution and the control of future pollution in the interstate waters of the New England area are of prime importance to the people and can best be accomplished through the cooperation of the New England States in the establishment of an interstate agency to work with the

States in the field of pollution abatement."

I think that statement in the preamble is the basis of the creation of the agency which I have the pleasure to head.

The draft of the compact was authorized by the Congress by vote on June 8, 1936, and was later approved by the Congress, and the compact was ratified by the seven signatory States.

That is an indication to me, and I believe it should be to you, that the legislative branches of the Government on a State level in the seven States, and also in the Federal Congress, have accepted this concept which I read, which comes from our preamble.

In the five years that I have had the pleasure of working with the agency, it has been a privilege to me to note that we were able to promote full cooperation among the State agencies, and I hope and expect that we shall continue to do that in the future.

I have purposely left with Mr. LaRiviere the presentation of our position paper this afternoon, because I want him to know you and to know all the people in New England who are interested in water pollution control on the interstate streams of the area.

I could not speak for the Commission. I would not attempt to speak for the Commission at this time of the details that have been presented to you. We have not had those matters before us. They will be before us now.

We shall continue to do our work as well as we know, as we have in the past.

Thank you.

MR. STEIN: Thank you, Mr. Hopkins.

Are there any comments or questions?

(No response.)

MR. STEIN: Mr. LaRiviere?

STATEMENT OF FRANCIS J. LA RIVIERE, CONFEREE AND EXECUTIVE SECRETARY, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION

MR. LA RIVIERE: On behalf of the Commission, I would like to present the following statement to the conference:

For many years the New England area has been involved in water pollution control problems because of concentrated populations and extensive waste-producing industries. With the public demands for clean waters, the States enacted effective water pollution control laws to meet the situation. However, as the States endeavored to carry out their respective pollution control programs, it became more and more apparent that in an area which is virtually a network of rivers crossing and recrossing State lines and in some instances forming the boundary between States, a coordinated interstate program was essential to a sound and equitable solution to the problem. Thus, in 1947 the New England Interstate Water Pollution Control Compact was drafted by the States, approved by Congress and ratified by the legislatures of Connecticut, Massachusetts and Rhode Island. Subsequently the other eligible States of Maine, New Hampshire, New York and Vermont became signatories to the Compact.

F. J. LaRiviere

The New England Interstate Water Pollution Control Compact is the legal instrument for cooperation between the States and provides the machinery for resolving interstate water pollution problems in the area. The Compact is administered by the New England Interstate Water Pollution Control Commission, which is composed of five members from each signatory State. An important part of the Commission organization is its Technical Advisory Board, composed of the directors of the State water pollution control agencies. The Board carries out the technical phases of the program and prepares recommendations for Commission consideration and action.

Recognizing the necessity of a balanced use of the area's waters to meet the various degrees of water quality required for the proper maintenance of the social and economic well-being of the region, the Compact sets up a procedure for classifying interstate waters according to highest use. This classification system is based on accepted water quality standards and reconciles the conflict of water uses by the assignment of use classifications which will best serve all interests concerned.

Under the terms of the Compact, each signatory State agrees to prepare classifications of its interstate waters according to present condition and proposed highest use and to submit them to the Commission for approval. After approval by the Commission, the States involved are pledged under the terms of the Compact to establish programs of treatment of sewage and industrial wastes to bring about the improvements required to meet the approved classification. The Commission has no authority to issue orders for pollution abatement. Such powers are retained by the individual States and used when needed to enforce classification requirements.

To coordinate and facilitate the preparation of proposed interstate water classifications by the States, subcommittees of the Technical Advisory Board have been established by the Commission for each of the interstate river basins and tidal areas. Each subcommittee is composed of the Board members from the States included in the basin or area. Coordinated sampling programs and sanitary and industrial waste surveys are arranged by each subcommittee to procure the necessary data for classification preparation. The proposed classifications are discussed at public and group meetings before being submitted to the Commission for approval.

The Commission is represented here today pursuant to a notice under date of December 15, 1964, from Anthony J. Celebrezze, Secretary of Health, Education, and Welfare, calling a conference in the matter of pollution of the Blackstone and Ten Mile Rivers on the basis that he has reason to believe pollution occurring in Massachusetts and Rhode Island is endangering the health and welfare of persons in Rhode Island and Massachusetts. The calling of such a conference is the first step in the enforcement procedure by the Federal Government under the provisions of the Federal Water Pollution Control Act (Public Law 660). Under this Act the primary responsibilities and rights in preventing and controlling water pollution are vested in the States. Federal enforcement action shall not displace State action to abate pollution unless the States fail to plan and execute an effective pollution abatement program.

The pollution control program as planned and executed by Massachusetts and Rhode Island for these waters is as follows:

In the early part of 1957 a Subcommittee on Classification of the Blackstone River Basin was organized by the Commission and an extensive coordinated sampling program in the vicinity of the State line was conducted during the summer. In addition, each of the State agencies collected samples at selected stations within its respective portion of the watershed. In this connection, special sampling tests and surveys were conducted on the Branch River, a highly industrialized tributary in Rhode Island.

In September 1958 the classification officially approved by the Commission generally upgraded the quality of the Blackstone River throughout its 42-mile course. Its future classification from the inlet of Fisherville Pond in Grafton, Massachusetts, to the Manville, Rhode Island, dam, is Class C. Branch River was simultaneously assigned a Class C from Slatersville Reservoir to its confluence with the Blackstone.

Similarly, after a cooperative study by the two States, the Ten Mile River was recommended for classification by the Subcommittee of the Technical Advisory Board, and received Commission approval in June 1956. This classification upgraded to Class C the section covered in the Department of Health, Education, and Welfare report.

Class C waters are suitable for recreational boating, irrigation of crops not used for consumption without cooking; habitat for wildlife and common food and game fishes indigenous to the region; industrial cooling and most industrial process uses.

The objective of the States is to assign the highest possible use classification which will be most beneficial to the public in general and at the same time is practical and can be attained under the circumstances. Class C was the highest use classification that could be proposed for both the Blackstone and the Ten Mile Rivers in the sections under consideration because of the extensive industrial development and the physical unsuitability of the shores for bathing beach development. The present lack of an economic solution to the problem of discharges from overflows on combined sewerage systems also precludes the development of bathing facilities.

The Class C category does not contain a bacterial water quality standard; however, the States have adopted a policy of chlorination of all sewage treatment plant effluents in order to eliminate discharges of untreated sewage into any waters.

Upon the adoption of this classification as the present goal for pollution control in the Blackstone and Ten Mile Rivers, the pollution control agencies of the two States initiated pollution abatement programs for compliance with the water quality standards.

To summarize, the pollution control situation in the Blackstone and Ten Mile River Valleys involved in this conference is as follows:

1. Comprehensive studies have been completed by the State water pollution control agencies.

2. Classifications for highest possible use under present circumstances have been approved.

3. Effective pollution abatement to meet the

classification is progressing at a satisfactory pace as will be demonstrated by the Massachusetts and Rhode Island conferees.

4. Communities and industries have cooperated in the abatement programs and Federal enforcement action is unnecessary.

Thank you.

MR. STEIN: Thank you.

Are there any comments or questions?

(No response.)

MR. STEIN: I have one comment for clarification first.

Our report talks about Class C for future highest use, and you say "highest possible use." Do you see any problem there? What do you suggest?

By the way, I am asking this for the purpose of clarification. This is not a probing question.

MR. LA RIVIERE: Highest future use.

MR. STEIN: All right. As I understand it, in the Federal report it says that the Blackstone and Ten Mile Rivers in the region of the Massachusetts-Rhode Island State line are considered Class D on the basis of present water quality, but you have classified them as Class C.

Is that correct?

MR. LA RIVIERE: Right. Yes, sir.

MR. STEIN: I think that this applies possibly, and I just want to put this forth here in the record, to your last notion that the Federal enforcement action is not necessary.

If the river is in fact Class D, and the interstate commission and the two States believe it should be Class C, and the Secretary is required to call a conference like this under the statute if he believes that health and welfare of persons in a State other than that where the pollution originates are being endangered, I don't know, if you were the Secretary, how you would construe your statutory obligation in any other way.

MR. LA RIVIERE: Well, I think the timing schedule comes into the picture there, Mr. Stein, and I think the Rhode Island and Massachusetts conferees will explain what the timing schedule is.

MR. STEIN: I am not talking about the timing schedule. I am talking about the obligations in the Federal statute. I do recognize your point.

I would like to make this clear. The Federal statute does not say that the Secretary is not to call a conference if someone has adopted a particular timing schedule. Sometimes these timing schedules have been adopted -- and I don't say that this has been the case in New England -- where they have dragged on for years and years.

The statute says that when the Secretary has reason to believe that pollution in one State is endangering health or welfare of persons in another State. he shall call the conference.

From what you have said, you are concerned with Class C. We are all agreed, I think, unless something comes out to the contrary from the other States, unless the report of the Government is wrong, the waters are Class D.

Under the law, I don't know whether the Secretary has the option of calling a conference.

If you believe the conference is unnecessary, I think the arguments or your forum is the Congress in dealing with the provisions of the Federal statutes. It is not with the administrators of the law.

I think the notion of the statute was to have conferences in these cases, and if a time schedule were appropriate, this would be the time schedule accepted by all, the States, the interstate agency and the Federal Government, and we would all see it go. #5

MR. LA RIVIERE: Well, I think what we are trying to accomplish is probably the same thing.

MR. STEIN: Yes.

MR. LA RIVIERE: As I say, the timing schedule is apparently what you people like to review, and conceivably, if the conferees of Massachusetts and Rhode Island indicated that the timing schedule is tomorrow, you probably would not disagree with it.

MR. STEIN: No.

MR. LA RIVIERE: Now, if any other timing schedule is presented, of course, that is subject to discussion and agreement.

MR. STEIN: Mr. LaRiviere, I would suggest that the timing schedule is not all we want to review. The appropriateness of it, I think, is for our consideration.

I might say, on the basis of our experience in the New England area, I don't think there has ever been a difference between the Federal Government and the State and interstate agencies on the appropriateness of classifications. The point is that you may not have thought this was appropriate, but we always saw eye to eye.

Subsequently, the experience has shown, not only in the cases where we have had enforcement actions, but in others, that the actions that your interstate commission has taken under you, and for many years before under Joe Knox, who has had a career as one of the best public servants in this field that we ever have had on any level, State, local, Federal or interstate, have been appropriate.

I think the question here is the timeliness of doing this.

Again, and this is just for clarification because I am sure we have the same objectives, in the statement before, when you talked, or Mr. Hopkins talked about the primary rights and responsibilities of the State and interstate agencies and other interested agencies, we may be, on the Federal level, that other anonymous interested agency, but the difficulty is we are very much here and present, and the Secretary does have a statutory obligation to do this. It is pursuant to his direction that we are here.

I don't think that we are here in any sense other than trying to be of service to the New England people, and I don't think that we are trying to be here in any sense other than carrying out our statutory mandates under our law, just as the Commission does under its law.

I just relate that to you and place this to you as being unnecessary. Under our law, as written, evidently the Secretary has thought this conference was necessary, and on the basis of what has been produced up to now and the state of our law, I don't see anything at least to change my mind on it.

MR. LA RIVIERE: Well, in connection with the statutory requirements, I think what you are trying to say is that the Secretary -- or when you say that the Secretary had no alternative but to call a conference because the health and welfare of the people of the region or of one State were being jeopardized by pollution occurring in another State, I don't agree that your report proves conclusively that the health of the people of another State was being jeopardized, because there is nothing in the report to indicate -- certainly there is no data on the epidemiology of the region to show that the health of the people in the area of the Blackstone and Ten Mile Rivers is any worse than it is anywhere else in the country, or anywhere else in New England.

MR. STEIN: I think we should wait for all the facts --

MR. LA RIVIERE: I think you are right there.

MR. STEIN: No. I think we should wait for all the facts to come in before we make a judgment on the basis of what you say.

Let me point out that the statute says when the Secretary believes that, and evidently he believed it to call a conference -- but let me call your attention to the kind of logic evidently you seem to be putting forward where you say that there was no danger to health or welfare, because this is no different than the situation which exists in other areas of the country and New England.

On the basis of our information on rivers, I do not think you really can equate it. I think water conditions both are better and worse in other areas of the country, but, sir, even if they weren't, there is a famous case in law where I believe Mr. Justice Cardozo wrote the opinion, who was later in the Supreme Court, where there was a collision between two boats and they didn't have radio equipment.

The defense was that all boats, or none of the boats really, or most of the boats did not have radio equipment. Justice Cardozo said that since radio equipment was available, there was no excuse that a lot of boats did not have radio equipment, and that radio equipment should be employed in the ships.

It would seem to me that even if this were the condition in all other areas of the country, if it in fact were a health hazard, it is going to be a health hazard.

In the report that I heard this morning, and this should be discussed, Mr. Mackenthun indicated that in the Blackstone or Ten Mile Rivers, coming into contact with the water in water contact sports, would constitute a health hazard.

If this is not the case, I think we should approach this on the facts, but this is what Mr. Mackenthun said, as I understood him, this morning.

Mr. Taylor?

MR. TAYLOR: I would just like to have one bit of clarification.

In this No. 4 that you have in the summary which you and Mr. Stein have been discussing, it says:

> "Communities and industries have cooperated in the abatement programs and Federal enforcement action is unnecessary."

Do you mean this as to the present time, as of this moment, or are you really intending to say "will be unnecessary"?

MR. LA RIVIERE: Well, if you can consider the present schedule, I think you come to the conclusion that it is unnecessary.

True, we are considering the whole program -- in other words, not only what has been done up to now, but what will be done in the next few years in the future.

MR. TAYLOR: I mean to say, do you think that this is the statement, or should it say that "further enforcement action will be unnecessary"?

MR. LA RIVIERE: Well, I consider this as the first step in the enforcement action. This is a requirement in the Water Pollution Control Act that, first of all, you should have a conference. Then comes the hearing, and then comes the formal court action of suit being brought against responsible individuals.

I think what we have here today is the first step. It is the enforcement action. It is part of the enforcement action.

MR. STEIN: What Mr. Taylor, I think, is saying is this -- and let me try this because I am trying to look for an accommodation -- if we can all agree, and we very well may have, on an appropriate time schedule, and all parties can agree that that is an adequate time schedule, wouldn't further Federal enforcement action be unnecessary?

MR. LA RIVIERE: Quite true.

MR. STEIN: All right. I think this may be the point that Mr. Taylor has indicated, which may be precisely the area on which we very amicably can go down the road and all go towards the same goal.

MR. LA RIVIERE: Right.

MR. STEIN: And satisfy the requirements of the State programs, the interstate program and the Federal program.

MR. LA RIVIERE: Well, I think our discussion, Mr. Stein, is a little premature.

MR. STEIN: Right.

MR. LA RIVIERE: Until we hear what the conferees from Rhode Island and Massachusetts have to say, we can't very well discuss this.

MR. STEIN: Right. Thank you.

Are there any further comments or questions?

(No response.)

MR. STEIN: If not, thank you.

Does that conclude the Interstate Commission presentation?

MR. LA RIVIERE: That concludes the Interstate statement.

MR. STEIN: Thank you very much.

At this point we would like to call on the State of Massachusetts, Mr. Taylor.

I would like to point out, while Mr. Taylor is getting up, that the colloquies here are just for the purpose of sharpening up the issues that are being presented in the conference, and are largely intended for that purpose so there can be a clear record and a clear resolution.

Mr. Taylor.

MR. TAYLOR: Mr. Chairman, members of the conference, ladies and gentlemen:

It seems to me that it would be appropriate to hear from two agencies that wish to make statements in regard to pollution control in Massachusetts before I proceed to give in detail the conferees' report.

Under those circumstances, may I call on Mayor Brennan, the Mayor of Attleboro, to make his statement?

STATEMENT OF THE HONORABLE CYRIL K. BRENNAN, ATTLEBORO, MASSACHUSETTS

MAYOR BRENNAN: Mr. Chairman, Mr. Taylor, members of the Commission, and ladies and gentlemen:

I am going to be very brief. I realize that in Attleboro, we who live in the Attleboro area, live in what is a dense industrial area.

The Ten Mile River has served industry in our area. Perhaps fifteen-plus companies in the Attleboros depend upon the disposal of their industrial wastes largely through the Ten Mile River.

The other problem of municipal wastes has been met in Attleboro through the aid of the Federal Government, through Public Law No. 660, and a grant obtained thereunder, and through the Accelerated Public Works Program, by which we have just achieved the completion of a better than three-quarter million dollar sewage treatment plant, which I submit, and I am sure it will be borne out, is doing a superb job.

It is one of the most modern plants in the Commonwealth at the present time.

We realize that in addition to our present use, we must be expandable in the future to take care of our municipal wastes. The plant is so constructed that it will take care of our future storage demands, and can be increased by increments of primary and secondary units.

We not only give primary and secondary treatment to the industrial wastes, but we also put it through sand filters, which were constructed many years ago, and which are in fine condition and have been rehabilitated.

In addition, we chlorinate so that the water we put back into the Ten Mile River at the present time is, I believe, of the highest quality of what can be considered an effluent from a municipal plant.

We realize that we have the industries which we must serve, and we are willing to cooperate in every way to raise the classification of the river.

We realize that we probably cannot achieve the highest classification under the code that you have, but we will cooperate in every way with our industries in trying to achieve the highest classification for the Ten Mile River, to the end that we will not in any way militate against the safety and health of a sister State and any area downstream.

Thank you.

MR. TAYLOR: Thank you very much, Mayor Brennan.

May I ask you, and only for the record, because I know the answer, was all of this accomplished since the date of the report that we have heard this morning?

MAYOR BRENNAN: No. The planning for our municipal plant goes back into the early 1950's.

I believe in 1953 and 1954, we took the initial steps, and we were prodded by the Department to take these steps, and they were rather insistent at times. We are grateful for that because that made it easier for us to get the capital funds to achieve this end.

We also are grateful to the Federal Government for the assistance in getting this money through the Department of Health, and it resulted in our getting roughly half of the money needed to give us this modern plant.

MR. TAYLOR: Thank you.

MR. STEIN: Are there any further questions or comments?

MR. PELOQUIN: The plant has been in operation since August?

MAYOR BRENNAN: Yes. Mr. Taylor's report does indicate that our plant is adequate.

The other report was based upon a time when, of course, the plant was not completed and was not in operation. It is in operation now and I am sure as far as the statistics stated on the first page of the report that was gone over this morning are concerned, we would have achieved a much better and higher percentage of bacteria control than is indicated there.

MR. PELOQUIN: You have secondary treatment with chlorination?

MAYOR BRENNAN: We have primary, secondary and we have rehabilitated our old sand filters, and there are many of them. The water is polished through them and then chlorinated, so that the class of water taken from the chlorinated effluent would be almost as clear as is pumped into our system.

MR. PELOQUIN: Thank you.

MR. STEIN: Do the mill wastes go into your plant?

MAYOR BRENNAN: No. We do not handle industrial wastes, but we do not have any of our surface drainage involved in our sewage system. We have two separate systems for our storm drainage and our municipal sewage.

MR. STEIN: You have a separated system?

MAYOR BRENNAN: Yes, we do, Mr. Stein.

MR. STEIN: That is pretty well separated? You don't have too much leakage?

MAYOR BRENNAN: We don't have any by-passes in them.

MR. STEIN: I don't mean by-passes. Sometimes one system infiltrates into another.

MAYOR BRENNAN: Well, I suppose with a system of our age, there is some ground water infiltration. I think there is an allowable factor of that in the system.

MR. STEIN: Thank you.

MR. PELOQUIN: Thank you very much, Mayor Brennan.

MR. TAYLOR: The League of Women Voters of Massachusetts, through the statement of Mrs. Ralph T. Salmi, representing the League of Women Voters for the City of Worcester.

Mrs. Salmi?

STATEMENT OF MRS. RALPH T. SALMI, REPRESENTING THE LEAGUE OF WOMEN VOTERS OF MASSACHUSETTS

MRS. SALMI: Thank you, Mr. Taylor.

It has been quite an experience for me to attend one of these hearings. I am actually not the State Chairman on Water Resources, but I am here representing her. Her name is Mrs. Bernard Flood from Lenox, Massachusetts, and she could not be here.

I am with the League of Women Voters in Worcester, Massachusetts, and have been working on this water resources item since the League first took it up for study in about 1957, I would say.

I am afraid some of the report that she has prepared for me you will find a little bit repetitious, but inasmuch as I agreed to read it for Mrs. Flood as prepared, I hope you will bear with me.

This is the third conference on interstate pollution at which the League of Women Voters of Massachusetts has testified, in the past thirteen months. Each time there has been ample evidence presented by various agencies, municipalities and private citizens that there is indeed gross pollution of our major interstate rivers. New England is in trouble now because of short-sighted policies of water use established early in our history. Industry needed the river as a source of power and as a means of carrying off its wastes. There were ample other sources of water for consumption and recreation, so no thought was given to the future. As communities grew and individual sewage disposal systems became inadequate, municipalities turned to the rivers again as a means of carrying off wastes. Gradually the expanded population and increased leisure time of our working force brought the conflicts for water use before the public.

Earlier, it was simple enough for industry to threaten to move out if they were forced to submit to the expense of clean up. It was thought to be foolhardy to "force" industry to leave just because some people wanted clean rivers, so nothing was done. But the fact is industry did leave - for other reasons. Furthermore, some industries cleaned up their wastes because they found waste products could be salvaged for economic value. Other industries were motivated by a desire to have clean water. Some industries would like to pollute less, but think that clean up is still too expensive, and some just don't care. Municipalities and citizens fall into these same categories when it comes to domestic sewage clean up. All segments of the community continue to pollute; some are openly opposed to abatement, others are apathetic. The Blackstone and Ten Mile rivers are plagued by the same problems as the other interstate rivers of New England.

In Worcester, for example, the League of Women Voters learned in its preliminary study eight years ago that the Worcester sewage treatment plant had been built in 1925 and was adequate if "there were no heavy rains and the plant was by-passed." Population growth, demand for clean rivers, and "rain" has resulted in a serious situation which the State Department of Public Health, in cooperation with the City Council has sought to correct. The city's application to the Housing and Home Finance Agency for Federal funds to facilitate a sewer survey was placed on file because there were no funds available. Facilities of the Worcester plant are being further taxed because of population growth in Holden and Rutland. These two towns have their wastes treated by the city's plant because their location in the watershed of the Metropolitan Boston Water Supply District precludes construction of a sewage treatment plant. Water from one of the largest tributaries of the Blackstone -- Kettle Brook -- is diverted by Worcester for its water supply. Thus, there is less water available at the plant to dilute the discharge. An appeal has been made to the General Court to permit Holden, Worcester, and six other towns, to establish a sewer district. However, no provision was made for funds to conduct the survey.

About a year ago the town of Grafton received the results of a sewer survey, which recommended construction of a sewer system. There had been no action on this matter until the announcement of today's conference. After a meeting on January 12th, when the Department of Public Health made a direct appeal to town officials, the chairman of Grafton selectmen indicated that the issue would be presented to the voters at the next town meeting.

At Uxbridge, the general manager of Waucantuck Mills, Inc., was quoted in the evening Gazette as saying that he would be forced out of business if he were required immediately to build a sewage system in response to a direction from the State Department of Public Health.

On the Ten Mile River we learned from talking with members of the newly formed League of Women Voters of Attleboro that there is both industrial and domestic pollution. The League is still too new to have studied the situation, but while they were gathering facts about the town for their "Know Your Town" booklet, they were told over and over again that serious pollution existed. They learned that several groups were trying to correct the situation. The Ten Mile River Commission was very actively engaged in seeking out the sources of pollution, and requesting a clean up, but much still needs to be done. Citizens are concerned and there is a willingness to correct the situation.

We have in the above recitation all of the classic problems facing the clean up of our New England Rivers. Rhode Island is concerned about the pollution coming into her State waters, and the Federal Government is using the appropriate machinery to help improve these rivers.

The League of Women Voters thinks that the Federal enforcement hearings have great merit, although we know they are not always happy occasions for our State officials. We sympathize with the State officials in their frustration with the slow pace at which clean up is proceeding in our State. We repeat our statement, made a year ago at the conference on the Connecticut River, namely, "Massachusetts has not accepted its full responsibility for pollution control. Matching funds for Federal programs are not always provided, nor has there been any State initiated program to municipalities for treatment plants. Most, if not all, of the State agencies have their programs severely hampered by lack of funds for research and personnel."

The League of Women Voters of Massachusetts will vigorously support the bills filed in this session of the General Court, which will give additional State funds for sewage treatment plant construction. We will support the

Department of Health and the Attorney General's Office in the vigorous pursuit of violators of the laws governing pollution of our rivers and streams. We shall continue to emphasize the importance of clean water with the Executive Department. We shall continue to support the present Federal legislation dealing with clean water, and the proposals for strengthening them. And, last but far from least, we will continue to encourage informed citizen action.

There is widespread interest in land and water use, and growing concern about pollution, but citizens fail to see how they can take part in the choices being made.

We believe that citizen organizations must take responsibility for the education of their members and the community on the need for stronger pollution control. Otherwise, the rivers will not meet present and future water demands, and the region will not remain attractive to industry and to people. Until the citizen sees the advantages of pollution control he will only look upon the expenditures for pollution abatement as another program competing for his tax dollar. Certainly, leadership on the part of the State and Federal agencies is needed, but citizens' support must be vigorously presented to city councils, the State Legislature, and to Congress, if we are to have the programs and funds needed to do the job.

In closing, we would like to comment on the fact that national, State and local political leaders are speaking out in favor of clean water. We think this will supply the leadership that has been so badly needed.

Thank you.

MR. STEIN: Thank you, Mrs. Salmi, for an excellent and comprehensive statement. Please express my gratitude to Mrs. Flood, whom we have seen before, for her contribution.

MRS. SALMI: Thank you.

MR. STEIN: Are there any further comments or questions?

MR. SHEA: No, I don't have any.

MR. STEIN: Are there any comments or questions?

MR. TAYLOR: I would only like to make one comment, and that is that the League is cooperating in every way possible with our Legislature, and otherwise, in promoting the bills that they have spoken of here, particularly those that have to do with State aid appropriations for our water pollution control, and State aid for the construction of pollution abatement facilities.

MRS. SALMI: Thank you.

STATEMENT OF WORTHEN H. TAYLOR, CONFEREE AND CHIEF ENGINEER, DIVISION OF SANITARY ENGINEERING, DEPARTMENT OF PUBLIC HEALTH, COMMONWEALTH OF MASSACHUSETTS

MR. TAYLOR: Mr. Chairman, members of the conference:

Under date of December 15, 1964, Anthony J. Celebrezze, Secretary, Health, Education, and Welfare, called a conference on the matter of pollution of the Blackstone and Ten Mile Rivers in Massachusetts and Rhode Island to be held under the provisions of the Federal Water Pollution Control Act (33 U.S.C. 466 et seq.), otherwise known as Public Law 660 of the 84th Congress, as amended. Notice of the conference refers to the Blackstone and Ten Mile Rivers in the States of Massachusetts and Rhode Island. However, in the Massachusetts area only such portions of these rivers as affect the water quality at the interstate line have been considered in the United States Public Health Service report relative to this matter. These are the waters from Worcester to the State line on the Blackstone River and from Plainville to the State line on the Ten Mile River. The report of the United States Public Health Service was prepared in part from data supplied by the States of Massachusetts and Rhode Island. In a general sense, the report is factual but the Department of Public Health, as the water pollution control agency of the Commonwealth of Massachusetts, does not agree fully with its conclusions.

It is my understanding that this conference must give consideration to three areas:

a. Occurrences of pollution of interstate waters subject to abatement under the provisions of Public Law 660.

b. Adequacy of measures being taken towards the abatement of such pollution.

c. Nature of delays, if any, being encountered in abating the pollution.

The presentation of the Federal Conferee has dealt with the first of these areas; this statement will deal mostly with areas b. and c.

A considerable portion of the Blackstone River watershed has been developed by the city of Worcester for municipal water supply and by industry for industrial water supply purposes. As a result, the flow in the stream during the summer dry weather period is regulated. Further, the population in and around the city of Worcester developed early and has increased steadily with major increases in suburban areas around the central city. A sewerage system

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was established in the city of Worcester around the turn of the century and a treatment plant has been in operation for many years. The treatment plant has undergone at least two major rehabilitations since its construction.

Parenthetically, I might add that the first treatment plant of the city of Worcester was a chemical precipitation plant. It was followed by a new system, and that was completely rebuilt a number of years ago, so that we have changed over from trickling filters to new recirculating types of filters in this area.

The downstream portions of the Blackstone River in the Commonwealth were also developed for industrial purposes by the so-called wet industries, mostly of the textile type. At most of these plants, dams were constructed which provided water power as well as a source of soft process water. These dams further regulated the flow in the stream. The downstream area of the river basin was particularly hard hit during the depression years and went through a very serious economic period. The area began to recover during the late 30's, and by World War II the industries in the area had been partially reestablished. Since 1952, the textile industry has fluctuated considerably with some businesses failing and others operating at a low level of production. As a result of the industrial development of the valley, the population centered in villages around the industries. The factory villages developed to an extent that they included sewerage systems, some of which included small treatment plants. These old systems still exist, but the sponsoring agencies have gone out of business.

In 1957 and 1958, the Department of Public Health conducted a study of the sources of pollution to the river, its water quality and use. In 1958 the river was classified by the New England Interstate Water Pollution Control Commission as to its then present condition and its future highest use; the classification is appended. Since that time, the Department of Public Health has carried on an abatement program to raise the water quality to meet the classification. As of the present time, considerable progress has been made, and in some cases construction of water pollution control facilities will begin in the near future. Generally, the municipalities and industries have shown cooperation and have provided a study or have prepared plans, as they were requested. The Department's program consists of informing the polluters of their responsibilities and requiring an engineering study and preliminary plans to meet the water pollution abatement needs. Upon completion of this preliminary planning, the Department confers with the polluter as to the time schedule and requirements of the next phase, consisting of preparation of construction plans. Following the preparation of the construction drawings the Department establishes a date of completion of the required construction. The table appended shows the status of water pollution control progress for the polluters along the Blackstone River with the date of completion of the next phase in each case.

Ten Mile River

The Ten Mile River was classified by the New England Interstate Water Pollution Control Commission in June 1956. The classification is appended. The portion of the Ten Mile River from Plainville to the interstate line is under consideration at this time. In the town of North Attleboro and in the city of Attleboro, considerable industrial development has taken place consisting mostly of jewelry and associated industries. Sewerage systems and sewage treatment plants were established in the town of North Attleboro and the city of Attleboro in 1906 and 1912 respectively. The treatment plants have been rehabilitated on several occasions in each case. At the present time, a consulting engineering study is being carried out in North Attleboro with a view toward improving the sewerage system and rehabilitating the sewage treatment plant. The city of Attleboro recently constructed a modern sewage treatment plant which at this time is considered adequate. Appended is the Commonwealth's water pollution control program for the Ten Mile River with the dates of completion of the applicable next phase.

The appended tables show the measures being taken toward the abatement of pollution and required completion date as prepared by the Commonwealth of Massachusetts. The Commonwealth feels that adequate measures are being taken and that cooperation is presently being shown with no delays anticipated. The Department of Public Health recognizes that pollution arising in Massachusetts affects the quality of water at the State line, but disagrees with the conclusion in the Federal Conferee Report that pollution from waters in Massachusetts was endangering the health and the welfare of residents in Rhode Island. The Department feels that in both of these small and highly developed streams pollution control can be accomplished and the reasonable future highest use classification adopted by the New England Interstate Water Pollution Control Commission can and will be met without protracted delays.

The schedule of what we are recommending is as follows:

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BLACKSTONE RIVER

Town or City

Worcester

Municipal Sewage - Existing treatment plant in operation. Housing and Home Finance Agency application for preliminary planning of rehabilitation in New York regional office. Study to be completed approximately 12 months after contract signing. Expected completion date July 1966.

Millbury

Municipal Sewage - Construction plans are completed. 50% of the funds for construction were appropriated at the 1964 town meeting. The additional 50% is to be appropriated at the next annual town meeting, which will be this year. The sewerage system will receive and treat industrial wastes as well as domestic sewage. Construction should be completed by April 1967.

Sutton

Industrial Sewage - Sniders Packing-Engineering report to be completed by October 1965.

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Grafton

Municipal Sewage - Engineering report and preliminary planning is completed. Construction plans to be completed by January 1966. Industrial wastes to be included in the municipal sewage system.

Northbridge

Municipal Sewage - There is an existing secondary sewage treatment plant. A study has been completed and Phase I of the rehabilitation program approved by the Massachusetts Department of Public Health; additional works are to be constructed in the summer of 1965.

Uxbridge

Municipal Sewage - Town meeting is to authorize HHFA loan application for preliminary planning. Municipal planning is to include the industrial wastes. Engineering report and preliminary planning are to be completed by February 1966.

Douglas

Industrial Wastes - Engineering report is to be completed by April 1966.

Millville

Municipal Sewage - Adequate individual subsurface disposal will be required. Industrial - Blackstone Wool Combing Company to have engineering report by September 1965.

Blackstone

Municipal - HHFA preliminary planning was authorized at the recent town meeting. Report and preliminary planning are to be completed by February 1966. Industrial is to be included in municipal report and preliminary planning.

TEN MILE RIVER

Town or City

Plainville

Municipal - Engineering report and preliminary planning are to be completed by March 1966.

North Attleboro

Municipal - Secondary sewage treatment plant now in operation. Rehabilitation study is underway and will be completed by June 3, 1965.

Attleboro

Municipal - Adequate secondary sewage treatment plant was completed in 1964. Industrial - Dodgeville Finishing is to discharge into the municipal system. Thompson Chemical is to complete engineering report by January 1966.

Seekonk

Industrial - Attleboro Dyeing & Finishing Company is to complete engineering report by January 1966.

INDUSTRIAL - SOURCES OF INORGANIC INDUSTRIAL WASTES

A complete waste survey has been completed on most of these industries. Generally, the wastes consist of heavy metals, acids and alkalies. The wastes normally require pretreatment before discharge to a municipal sewerage system. Normally, the same treatment coupled with good housekeeping practices are sufficient treatment for discharge into the stream. The study by each industry and certain in-plant changes are to be completed by January 1966.

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CLASSIFICATION OF BLACKSTONE RIVER

From the outlet of Steel Mill Dam at Greenwood Street, Worcester, to inlet to Fisherville Pond at Pleasant Street in Grafton.

Present Condition - Class E
Future Highest Use Classification - Class D

From inlet to Fisherville Pond at Pleasant Street, Grafton, to Massachusetts-Rhode Island State line upstream from the Branch River.

Present Condition - Class D
Future Highest Use Classification - Class C

From Rhode Island-Massachusetts State line at a point downstream from the Branch River to the Massachusetts-Rhode Island State line downstream from the town of Blackstone.

Present Condition - Class D
Future Highest Use Classification - Class C

Mill River from source to outlet of Draper Pond.

Present Condition - Class B
Future Highest Use Classification - Class B

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Mill River from Draper Pond to outlet of Spindleville Pond.

Present Condition - Class C

Future Highest Use Classification - Class C

Mill River from outlet of Spindleville Pond to Massachusetts-Rhode Island State line.

Present Condition - Class C

Future Highest Use Classification - Class B

Peters River from source to Wrentham Street in the town of Bellingham.

Present Condition - Class B

Future Highest Use Classification - Class B

Peters River from Wrentham Street, Bellingham, to Massachusetts-Rhode Island State line.

Present Condition - Class C

Future Highest Use Classification - Class B

All other streams in the Blackstone River watershed area which cross the Massachusetts-Rhode Island State line.

Present Condition - Class A

Future Highest Use Classification - Class A

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Approved by the New England Interstate Water Pollution Control Commission on September 24, 1958.

* * *

CLASSIFICATION OF TEN MILE RIVER

From source to Bacon Street, Plainville.

Present Condition	- Class B
Future Highest Use Classification	- Class B

From Bacon Street, Plainville, to the North Attleboro-Attleboro boundary line.

Present Condition	- Class C
Future Highest Use Classification	- Class B

From North Attleboro-Attleboro boundary line to outlet of Farmers Pond.

Present Condition	- Class D
Future Highest Use Classification	- Class D

From Outlet to Farmers Pond to the Massachusetts-Rhode Island State line.

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Present Condition - Class D

Future Highest Use Classification - Class C

The Seven Mile River from its source to the outlet of Orrs Pond.

Present Condition - Class A

Future Highest Use Classification - Class A

The Seven Mile River from the outlet of Orrs Pond to the Massachusetts-Rhode Island State line.

Present Condition - Class D

Future Highest Use Classification - Class C

Speedway Brook from its source to the Ten Mile River (Dodgeville Pond).

Present Condition - Class D

Future Highest Use Classification - Class C

All other tributaries to the Ten Mile River.

Present Condition - Class B

Future Highest Use Classification - Class B

Approved by the New England Interstate Water Pollution Control Commission on June 19, 1956.

Thank you.

MR. STEIN: Thank you, Mr. Taylor.

Are there any comments or questions?

MR. SHEA: No, I don't have any.

MR. STEIN: Any comments?

MR. PELOQUIN: Yes, I have a couple of questions, Mr. Taylor.

You indicate that you provide or agree to a time schedule to meet with the municipalities, and this in your statement appears to come into effect upon completion of preliminary planning.

Do you have a time schedule established which will provide for completion of the preliminary work, or can this go on indefinitely?

MR. TAYLOR: The dates of the completion of the reports have been indicated in almost every instance, except in cases where the Housing and Home Finance Agency is included.

The Housing and Home Finance Agency contract usually provides for the date of completion of the studies. Usually the maximum is twelve months, and thus, with no assurance as to the date at which the Federal grant will be made available or the Federal loans under HHFA, we do not dare to make a firm commitment in this regard, but these would be the dates that would be established by HHFA for the length of time granted to the engineers to make these studies.

MR. PELOQUIN: If there is no HHFA activity involved here, then you establish the schedule or give them a deadline in which to complete the preliminary work?

MR. TAYLOR: That is correct. It has been stated in other instances by date.

MR. PELOQUIN: Now, on your list, or your schedule, I should say, on municipalities, with regard to the expected completion date, July 1966 is completion of the study by the city of Worcester. Is that right?

MR. TAYLOR: Yes.

MR. PELOQUIN: That is the study?

MR. TAYLOR: That is indicated that way. Yes.

MR. PELOQUIN: On Sutton in connection with this engineering report, what do you anticipate here? This would be an in-plant treatment or a means of tying into the system?

MR. TAYLOR: There is no system here into which they may tie. They must provide an adequate method of pollution abatement.

Rather, it includes simply in-plant changes that would eliminate pollution of the river, or if they are going to have residual wastes, required treatment will be included in the report, the type of treatment, and the plans for it.

MR. PELOQUIN: One more question: On the municipalities where you indicated that either construction would be started or completion of reports, you have given completion dates for reports.

Do you have a schedule established for completion of construction?

MR. TAYLOR: No, sir. The program will depend somewhat on the completion date of the study, and then we will negotiate with the community as to the completion date of the works.

The reason for this is that there are some communities that have commitments that would indicate a possible short delay. There are other municipalities that have to depend upon town meeting action, and such things as that, so that we would like to tie the two together in a firm commitment; but what we in every instance do when the reports are completed is that we sit down with the town fathers and come to an agreement, wherever possible, on the date.

If we cannot settle upon the date, we will then have to go through the legal channels.

However, if the Department of Public Health should feel that April 1966 should be the date of completion, and they should say, "We can't do it by that time and would like to consider July," we will say, "Yes, in July."

MR. PELOQUIN: Thank you, Mr. Taylor.

MR. STEIN: Mr. Taylor, just one comment. I would like to hold this, of course, until we hear from Rhode Island, but I think you have been in this two or three years now?

MR. TAYLOR: Three.

MR. STEIN: Off the record.

(Discussion off the record.)

MR. STEIN: I would like to point out, Mr. Taylor, that a firm date as to construction very often is helpful to HHFA. I think it is very well known, and I think HHFA makes this known, and we do, that they do give consideration to action such as this, to schedules that we have, and I think that in this whole action we can be of help to you in HHFA in relationship to priorities.

Now, again, waiting for Rhode Island, because I do think we have to be equitable in this, I think the key point -- and I would like to reserve this until later -- as you know, is a construction schedule and the dates for construction.

In many cases these are not here, and I don't know that it would be wise at this point in the development of this to proceed until we hear from Rhode Island and see what Rhode Island has to say with regard to its program.

MR. TAYLOR: I recognize this, Mr. Stein. I would only like to point out one thing, and that is that neither you nor I nor HHFA can tell you when monies are going to be made available.

The monies available through HHFA are on a revolving fund and also by Federal appropriation, but largely it is a revolving fund. It is provided in HHFA that the monies will be repaid at the start of construction, and if a program does not get started, HHFA does not get its money back.

We have been before HHFA on several occasions, and they have told us, "Yes, this will be approved, but we have to wait until somebody pays us back the money before we can make it available to you."

This is the situation in which Worcester and some of these other communities are at the present time.

HHFA is pleading poverty like the rest of us. They haven't the money that they can loan out at this time, and thus we are unable to set a schedule based on the availability of their funds.

MR. STEIN: We recognize that, but again, just let me point out that HHFA has a priority, like anyone else, for making funds available.

When a construction schedule is set under one of these proceedings, HHFA has a tendency to look at that and give that full consideration in assigning its priority. But then we have not heard from Rhode Island, and I would not like to set this here.

I don't know what Rhode Island is going to say, but it seems to me that as we have been in the Merrimack and the Connecticut Rivers, it would be best for a schedule of this kind to be proposed by a State agency, rather than unilaterally by the Secretary.

I might say that, looking at our history on this in other areas of the country where difficulties have come up, and if you want to discuss those I will be glad to, but I don't want to put them on the record here because these cities are outside in other areas -- things do happen, you know. Cities get into financial difficulties that have #6 nothing to do with water pollution control, or mistakes are made in engineering and the plant doesn't stand on its functions and slips, or other judgments are made that create problems, or some problem happens with financing. I don't think that we, the interstate agency, you or Rhode Island, would not take that into account.

However, as you know, the Secretary would be interested in a rather firm statement of when we can expect these plants to be completed.

MR. TAYLOR: I am sure you are right, Mr. Stein.

This was done in the case of the Connecticut River and was thus approved on this kind of a schedule for both Massachusetts and Connecticut, but on the Merrimack River you chose to approve the other type that is here recommended.

MR. STEIN: No. We had a pretty firm schedule on the Merrimack River.

MR. TAYLOR: Not as definite as this.

MR. STEIN: It was more definite than this. Let us get it on the record, because on the Merrimack River every issue we were to take up was to be by construction by X date.

The point is that here -- and this is the key point and I think we should put it down and make it clear -- I think the Secretary would look askance at something which would not come up with a commitment to construction, but allowed this to terminate at a study or planning stage, with construction to be negotiated some time later.

MR. TAYLOR: But I would suggest that we would be very glad to amend this by stating that the negotiations would be completed within three months of the time after the studies were completed.

MR. STEIN: May I ask, for the purpose of equity, and I don't know what the situation is here, that we listen to Rhode Island, because obviously I think in an even-handed operation we are not going to suggest anything, or at least I don't think anyone should, which would be at substantial variance with the Rhode Island program.

MR. TAYLOR: I don't want to say yes now.

MR. STEIN: Do you have any more statements, Mr. Taylor?

MR. TAYLOR: I have not received any indications that anybody else from Massachusetts wished to make any statement, but if there are any other persons who would like to make statements relative to either the Blackstone or the Ten Mile River, we would be very pleased to hear them.

(No response.)

MR. STEIN: There being none, that will conclude the presentation of Massachusetts.

We will now call on Rhode Island. Mr. Shea.

MR. SHEA: Mr. Chairman, conferees, ladies and gentlemen:

I think it would be a much more orderly presentation if I were to read my statement here and then have others add their comments, but a number of people have come to say something who have been here all day, and I had to plead with them to remain here all afternoon, so I am going to twist things around a little bit and, for their convenience, so that they can get out of here, I am going to ask those people from Rhode Island who have indicated a desire or willingness to make a statement, to do so at this time.

First I would like to ask Mrs. Ralph Anderton of the League of Women Voters to make a brief statement that she has prepared.

Mrs. Anderton, please.

STATEMENT OF MRS. RALPH G. ANDERTON, REPRESENTING THE LEAGUE OF WOMEN VOTERS OF EAST PROVIDENCE, RHODE ISLAND

MRS. ANDERTON: I am Mrs. Ralph Anderton, Water Resources Chairman of the League of Women Voters of East Providence.

Mr. Chairman, conferees and guests:

The Ten Mile River is the major water supply of the city of East Providence, Rhode Island. For many years now the city has been concerned over the increasing pollution of the river and last year the East Providence supply was pronounced, by the State Sanitary Engineer, the poorest in the State of Rhode Island.

The amount of treatment necessary to make this water safe for use gives it an offensive taste, odor and appearance which increase as the pollution increases.

Under mounting pressure of citizen protests the City Council sought suitable solutions and as the greatest pollution sources are upstream, in Massachusetts, an entirely new water supply seemed the best answer.

Permission was sought and obtained to buy water from the city of Providence after completion of a costly tie-in project. East Providence voters authorized a $7,000,000 bond issue for such a project last spring and the first step of construction is underway. However, it will be three years before it is completed and pure water is available in our faucets.

Much as we anticipate that time, it does not lessen in the least our concern over continuing pollution and the need for its abatement. The Ten Mile River flows through one of the city's few remaining "green acres" areas scheduled for recreational development.

It was interesting to hear this morning that even the sludgeworms were annoyed with it. (Laughter.) The river has been declared unfit, in its present condition, for even minimal recreational use.

Although we recognize that some remedial efforts have been made by both States on both rivers under discussion today, the efforts obviously have not been great enough or rapid enough.

While League members believe that States and communities should fulfill their responsibilities for maintaining water quality, we know that in some situations -- especially in interstate waters -- it is necessary for the Federal Government to assume leadership before adequate improvements will be made.

The League of Women Voters of East Providence will continue to support progressive developments dealing with clean water and to keep our community informed and active on the same.

Thank you.

MR. STEIN: Thank you.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, thank you very much.

MRS. ANDERTON: Thank you.

MR. SHEA: Let me add my voice of thanks.

Mrs. H. William Koster, President of the League of Women Voters of Rhode Island, was here this morning and asked me to place this statement of hers in the record, please.

MR. STEIN: There being no objection, that will be done.

(The statement referred to is as follows:)

STATEMENT FILED BY THE LEAGUE OF WOMEN
VOTERS OF RHODE ISLAND AT THE FEDERAL-
STATE ENFORCEMENT CONFERENCE ON POLLUTION
OF THE BLACKSTONE RIVER. PROVIDENCE, R.I.,
JANUARY 26, 1965

Mrs. H. W. Koster

I am Mrs. H. William Koster, president of the League of Women Voters of R. I. I appreciate the opportunity to make a short statement on behalf of the League of Women Voters of R. I.

For the last two years we have been studying the problem of drinking water resources in R. I., working actively before the Nov. election for the passage of the bond issue for reservoir sites acquisition. Under our national program, we have studied national policies and procedures for the conservation and development of water resources. But we have not made any recent state-wide study of pollution of R. I. waters. Therefore, in line with our policy of study before action, we are in no position to report on any specific problems here today, although one of our local leagues, Pawtucket, is present for that purpose.

What we do wish to say is that we are here to observe both as members of the League and also as citizens. As such, we can perhaps render our most useful service to you. If we are kept informed of your reports and your plans for pollution abatement, we can in turn pass this information on to our members and to the general public. If future legislation is required, this, too, we can try to interpret to our members and the public. If citizen committees are needed, we might be able to help organize these and to serve on them. In other words, we are suggesting that we might be in a position to help build public opinion for and understanding of the reasons for the acceptance of certain improvements you may want to propose. Without an informed and sympathetic citizenry, your future work could be hampered and unnecessarily delayed.

Naturally, we cannot commit ourselves to any definite procedures until we have had a chance to study them. But we do offer to cooperate wherever we can. We wish this conference the greatest of success and hope that it will continue in the spirit of cooperativeness. We realize this conference is only the first step in pollution control, but it is a necessary first step. The sources of pollution can and should be identified, again in the spirit of cooperation, rather than recrimination. By working together, planning together, solutions satisfactory to all can be found.

Gentlemen, we share your concern for water pollution. We congratulate you for taking the first step in its abatement, and we offer you our cooperation wherever possible. I thank you for your time.)

* * *

MR. SHEA: Among the people who have indicated a willingness to make a statement at this time is a representative of the City of Woonsocket, His Honor, the Mayor, Mr. Coleman.

MAYOR COLEMAN: Mr. Corey will make the statement, Mr. Shea.

MR. SHEA: Mr. Corey is the Director of Public Works of the City of Woonsocket.

STATEMENT OF FRED L. COREY, DIRECTOR OF PUBLIC WORKS OF THE CITY OF WOONSOCKET, RHODE ISLAND

MR. COREY: Gentlemen:

As officials of the City of Woonsocket, we feel it incumbent upon us to make a statement concerning our position in the matter of pollution of the Blackstone River as it flows through our community.

In order to do this, we would like to touch upon the past, present and future of this problem. Over the years, the banks of the Blackstone River in Woonsocket have attracted many textile manufacturing industries, and with them problems of stream pollution peculiar to their processes. For years, like many communities, these dyeing and processing plants have contributed to the pollution of the Blackstone River.

F. L. Corey

Since the early 50's, despite economic problems, and a major flood, the city of Woonsocket has demonstrated not only a recognition of its public problems, but has proceeded to do something about them.

In the period since 1956, some $35,000,000 have been spent in our community of 47,000 on capital improvements. $7,000,000 of this figure has gone into the area of sanitation. In addition to the recently completed primary sewage treatment facilities, we have recently put into operation a water treatment plant and a municipal incinerator.

As for the present, we now have under construction a two-stage $14,000,000 flood control project within the geographical confines of the city.

We have taken your time to give you these facts because we feel they must necessarily be known to demonstrate our actions in the matter under discussion here today and in order that you understand our overall economic position for the future.

Our plans for the future in the area of stream pollution control consist of a review of the requirements and the installation, if necessary, of a low-level sewer on the river bank to collect industrial waste. In addition, plans have been made for, and our primary sewage treatment facilities have been constructed to accommodate, necessary additional secondary treatment.

Recommendations have been and will continue to be made to those people who make policy and plan priority for the construction of the collection and treatment facilities that remain.

We are confident that the city of Woonsocket will continue to recognize its obligations and will proceed with these necessary facilities as rapidly as its economic position will allow.

I would like to say, however, that we feel that the timing of the gathering of the data of this report was indeed unfortunate.

For unavoidable construction reasons, the city of Woonsocket was forced to by-pass raw sewage directly into the Blackstone River for a short period of time at the very same time that samples which were used for this report were being extracted from the river.

It is our opinion that if this report is to be considered current, the sampling below the Woonsocket sewage treatment plant be made on the basis of currently operating facilities.

Thank you.

MR. STEIN: Are there any comments or questions?

(No response.)

MR. STEIN: If not, thank you.

Go ahead, Mr. Shea.

MR. SHEA: The Public Health Service report which you listened to in some detail this morning pointed out two industries on the Branch River, a tributary to the Blackstone, as offenders.

At this time I would like to call upon a representative of the major or or the larger contributor, said to be the larger contributor of these two, a representative of the Branch River Wool Combing Company.

STATEMENT OF GASTON WARLOP, PRESIDENT,
BRANCH RIVER WOOL COMBING COMPANY,
N. SMITHFIELD, RHODE ISLAND

MR. WARLOP: My name is Gaston Warlop. I am President of the Branch River Wool Combing Company and manage the plant.

I have no prepared statement to make. I hope you will bear with me to be brief and to the point.

It is not my idea to contradict the end results of such an extensive survey. I claim they were certainly acute at the time, which was in August 1964.

Also, I would like to pass a remark here that I was wondering why the survey collected only at the two plants mentioned in this report, and not one word about the ten other industries, some of which have some very antiquated sewage disposal facilities, which is not the case for Branch River.

However, let me say that at the present time I am happy to announce that this report will not be true any more. In August 1964, we had an unfortunately accumulating circumstance, which made it look very bad indeed. As you know, we had two sources of overflow into the Branch River. One was from our drainage and the other one, a very strong one, it is claimed was from our waste disposal coming from our spent liquid.

At that time we had at our disposal three lagoons, one of three and a half acres, one a half an acre, and one about a quarter of an acre. Of course, at that time all those three lagoons were in the process of being emptied, Since then, we took advantage of our big facility to have a greater land area, to consider another big lagoon more or less about 200,000 square feet, about four and a half acres, with a minimum depth of five feet, making it about a million cubic feet, or 7-½ million gallons of water.

There is, at the present time, no output whatsoever collecting from the lagoon to the Branch River. We hope to maintain this standard so as not to have the Branch River collect any more, resulting in pollution of the Branch River.

This has been our project No. 1, which is terminated at the moment.

There is no present -- and I repeat -- there is no present scheme for using the Branch River at the present time.

All I have to say, to conclude, is with the advice and the help of the State Department, we will be able to keep this going.

Thank you.

MR. STEIN: Thank you.

Are there any questions or comments?

MR. PELOQUIN: You say you have a new lagoon in operation now with no outlet?

MR. WARLOP: No outlet.

MR. PELOQUIN: Do you have three other lagoons in operation now?

MR. WARLOP: No. We have three lagoons, one three and a half acres, one a half acre, and one four and a half.

Next year we will always have two lagoons in operation, and one being emptied. We are counting on the evaporation, which I believe is about two feet per year, to keep those lagoons from overflowing into the Branch River.

MR. PELOQUIN: Are you eliminating the outfalls from the present lagoons to the river?

MR. WARLOP: They are eliminated now.

MR. PELOQUIN: But only because of the lagoon?

MR. WARLOP: Because of constructing that big lagoon.

MR. PELOQUIN: But is there a possibility that there could be more discharges to the river when your lagoon gets full?

MR. WARLOP: Well, you must also take into consideration that the Branch River now is on a limited production basis of about 50 percent.

Branch River is not producing what it did last year, and certainly not the year before. You know very well that the Branch River, like all textile industries, are fighting for survival, and this is also an opportunity for me to ask for your understanding in this so-called fight.

MR. PELOQUIN: I might add, sir, I did state this morning that we do have research facilities available to industries, municipalities and State agencies, and working through the State pollution control agencies. These facilities are available for assistance.

I would like to ask you one other question. You mentioned there were ten additional industries. These are located where? Right in your area?

MR. WARLOP: Well, this is known. You just go through Blackstone and Millville and that area and see for yourself.

You know, I am not an expert, but I would like to know why you did not study the flow before and after Branch River.

We are certainly to blame. We were to blame, and I would hate to throw the blame on to somebody else. However, it is just a simple fact, with no names, and maybe I should not have mentioned it because there is no excuse in blaming somebody else for what you have done --

MR. PELOQUIN: This is true. I was under the impression that we had included all industries in the basin and the major tributaries, which are the Branch and the West Rivers and the Mumford. We had included all industries. I considered all industries within the basin.. This is my impression.

Now, I know that there are industries in Woonsocket that are tied into the municipal system, and they are noted as such.

MR. WARLOP: I believe there are about eight or nine miles more upstream full of industries.

MR. PELOQUIN: I will have to consult with our staff on this one. I was sure we had everything covered.

It was not intentional that we segregate or single out any specific industry. It was our intent to cover all industrial wastes, as well as municipal wastes, in the area.

MR. STEIN: I have one comment for clarification.

Sir, I want to assure you that on the basis of our records, we have never put anyone out of business because of pollution control. That is not our object.

As I have said many times, it is a very easy thing to accomplish pollution control by putting someone out of business. The challenge is to have pollution control and keep the business going.

On the basis of what I have seen, no one has gone out of business. I never saw a substantiated case, not only by us, but I have never heard of one by an interstate agency or a State agency.

I have heard this story many, many times throughout the years. If this is ever shown, I would like to see one case. It just has not happened.

There are two points I would like to mention here: One. As I understand it, sir, there will not be in the future any waste coming from your plant to the Branch River. You have a closed lagoon system, and you are depending on evaporation to make these facilities available while you are using other lagoons.

Is that a fair statement?

MR. WARLOP: This is an accurate statement, Mr. Stein.

MR. STEIN: I would like to call Mr. West. Would you come up, Mr. West, for one second, on this question of the Branch River?

MR. A. W. WEST: Certainly.

MR. STEIN: Let's clarify this, if we can.

Mr. Warlop, will you just wait for a moment, sir?

Mr. West, can you answer that question about did we sample plants other than this one on the Branch River?

MR. WEST: I can answer the question.

We did look at the river above Stamina Mills and above Branch River and we had a control station above both of them, and we found no residual pollution from above that could cause any interstate pollution.

In other words, the water above that was pretty good. We don't know what the effect was in the immediate vicinity of these upstream industries, but it did not carry down into this area.

MR. STEIN: Sir, may I go to the map? Maybe this will help us all out on this. Let me try to explain this.

By and large, the river flows from Massachusetts into Rhode Island. The only pollution that we, as a Federal Government, can be concerned with is if pollution started up here in one State, here in Massachusetts, and persisted to Rhode Island.

If pollution starts up here (indicating) and you may have a loathsome condition, but by the time the river gets here (indicating) this pollution has lost its effect long before it gets to the State line, and then, while this may be a local problem and a problem certainly for consideration by you and the State authorities, we in the Federal Government have no jurisdiction in a case of this kind. This is left out of the Federal report.

If I understand Mr. West, here is what he is saying: The other sources on the Branch River, while they may have been creating a local situation, and I am not making a judgment on this, certainly, by the time they got to the lower reaches of the Branch River, had their effect dissipated and did not have an effect when it got to the State line.

Is that correct?

MR. WEST: Even more so. I can now show the record -- I found it -- but at this point here (indicating), whatever pollution may have entered above had recovered, and we had dissolved oxygen on the average of 9, and the lowest was 8. These are all above our objective. I am talking numbers.

The BOD was down to 3.5, but the mechanism which we used to see whether or not there is an adverse effect of pollution indicated that this pollution, regardless of what happened here, did not adversely affect the stream, even down to this point (indicating), and therefore would have had no effect on the interstate area.

MR. STEIN: Thank you very much, Mr. West.

Do you want to comment, or is that satisfactory?

MR. WARLOP: No. I think Mr. West gave me the explanation I needed.

MR. STEIN: Thank you very much.

MR. SHEA: Thank you very much, Mr. Warlop.

Now, one of the other industries that has been pointed out on the Branch River as a contributor is the Stamina Mills Company.

At this time, I would like to have a representative of that firm make a statement.

STATEMENT OF JOHN E. GRAHAM, III, ESQ.,
ATTORNEY AT LAW, 1908 INDUSTRIAL BANK
BUILDING, PROVIDENCE, RHODE ISLAND

MR. GRAHAM: Mr. Chairman, conferees, ladies and gentlemen:

I have a very brief prepared statement, but before I go into that, I want the record to show that in the interests of preserving its rights and preserving the record, the record should show that by its appearance at this conference, Stamina does not waive its right to challenge jurisdiction, admissibility of exhibits or admissibility or authenticity of testimony or witnesses, and its appearance here should not be construed as a waiver of any of its rights in this conference or any subsequent conferences, hearings or proceedings.

MR. STEIN: Thank you, sir, and may I point out to you and the participants and conferees, that the same applies to them.

This is what I want to point out. This is a conference. You are not giving testimony and making statements. You are not under oath, and there is no cross examination. There is no waiver of any jurisdictional or substantive right whatsoever by your appearance at the conference.

The record will show that.

MR. GRAHAM: Thank you, Mr. Chairman. I wanted to establish that.

MR. STEIN: Very well.

MR. GRAHAM: In the absence of specific material furnished prior to January 25, in behalf of my client Stamina Mills, I want it to appear on the record that our attitude is sympathetic to the problem raised and want the record to show that we have had numerous conferences with the Rhode Island Department of Public Health, and in conjunction with our cooperative attitude that we intend to conduct a program that would be affirmative in its approach to resolving the problem raised in the report and the various statements and testimony that developed at the conference of January 26, 1965.

MR. STEIN: Are there any comments or questions?

(No response.)

MR. STEIN: If not, thank you very much.

MR. SHEA: Thank you, Mr. Graham.

We invited a number of people from Rhode Island and offered them the opportunity to make statements if they chose to do so.

As far as I know, the people who have already made statements include all of those who wanted to do so. If, however, there is anybody else from Rhode Island who would like to make a statement, I would be pleased to offer him the opportunity to do so now.

Is there anyone else?

(No response.)

MR. SHEA: If not, I will proceed in making the statement of the pollution control agency of the Department of Health of Rhode Island.

STATEMENT OF WALTER J. SHEA, CONFEREE AND ASSISTANT DIRECTOR OF HEALTH IN CHARGE OF ENVIRONMENTAL HEALTH SERVICES, RHODE ISLAND DEPARTMENT OF HEALTH

MR. SHEA: The Blackstone, the largest of the rivers of the State, has been the site of intensive industrial development for a century. It has provided water for industrial processing and power on a large scale. It has been called upon to carry away the wastes of industrial processing and the large population settled there as a consequence of its industrial growth. The abatement of pollution of the river has been a major concern of the State Department of Health, the State's water pollution control authority; it has occupied a principal place in the department's program.

W. J. Shea

In an effort to coordinate the pollution abatement work of Rhode Island on the Blackstone River with that of Massachusetts, the two States in 1958, after detailed study, agreed upon a classification representing the river's present condition, and a condition planned for the future. This classification was approved by the New England Interstate Water Pollution Control Commission in September 1958.

The classification agreed to and approved was as follows:

The present condition of the river from the Rhode Island State line to Hamlet Street Bridge in Woonsocket -- Class D, suitable for transportation of sewage and industrial wastes without nuisance and for power, navigation and certain industrial uses. From Hamlet Street Bridge, Woonsocket, to confluence with Sneech Brook below Manville Dam -- Class E, grossly polluted. From confluence with Sneech Brook to its mouth -- Class D.

The future highest use classification adopted provided that the river from the State line to Manville Dam would fall into Class C, suitable for recreational boating, habitat for wildlife and fish indigenous to the region, industrial cooling and most industrial processes; from Manville Dam to Lonsdale Dam -- Class B, suitable for bathing, boating, and recreation, good fish habitat and good aesthetic value; from Lonsdale Dam to its mouth -- Class C.

Now to summarize what has been done up to this time to accomplish a clean-up of the river.

All the sewage collected in municipally owned sewers and discharged into the Blackstone River is being treated. To accomplish this, the Blackstone Valley Sewer District Commission, established by law in 1945, has since then spent over $15,000,000 for the construction of intercepting sewers and sewage treatment facilities to deal with untreated sewage and industrial wastes in the lower Blackstone Valley. The city of Woonsocket has just completed the construction of new sewage treatment facilities at a cost of $1.8 million.

There remain some unsolved problems. They are almost entirely in the disposal of industrial wastes. It is well known that even the industrial wastes problem is much smaller than it was a generation ago because so many textile finishing plants have closed down their operations.

In 1954 there were twenty-two industrial plants emptying polluted waste waters into the main stem of the Blackstone River in Rhode Island. Of these, only ten now discharge directly to the river; six have liquidated and six have connected to the city sewer.

W. J. Shea

In the many conferences held over the years by representatives of the Department of Health with the city of Woonsocket, it was agreed that if the city were to take care of not only the city's sewage, but that of the industries located in the city discharging to the river directly, a program of construction would have to be carried out in phases. Such an understanding became necessary because it seemed clear that lack of space alone would prevent industry from providing its own treatment facilities, and also because the city could not finance a satisfactory program of construction all at one time.

It might be added that it is foolhardy to attempt to prescribe secondary treatment, for example, for an unknown mixture of sewage and industrial waste, and until all these are brought together to one point and proper experiments carried on, it is only then that a proper design can be made.

The first phase of the city's program was completed this past summer. All of the city's sewage is now receiving primary treatment and up to one-half is receiving secondary treatment. All of it is being chlorinated. The next phase of the city's program is to connect to the city sewers, industries not now connected. When last investigated by the city's consulting engineers some time ago, it was thought that to accomplish this, a low level relief sewer would have to be constructed. Since the number of waste-producing industries located in the city have diminished substantially since this determination was made, a new look at the problem will have to be made. The city has agreed to do this. A third phase of the city's program will follow the second. It will consist of an expansion of existing secondary treatment facilities to provide secondary treatment for all the sewage collected in the city's sewers. It is hoped that representatives of the city will, in a statement, provide more detail on the city's future plans.

The report of the United States Public Health Service, made the basis for this conference, points to the Branch River Wool Combing Company, located in North Smithfield, as a principal contributor of pollution through the discharge of industrial wastes into the Branch, a tributary of the Blackstone. We have been in conference with representatives of this company and find that this contribution has stopped, and that the company has installed means which it promises will avoid any future waste discharge. A statement in this matter has been made by a representative of that firm.

A lesser contributor of pollution to the Branch River, the Stamina Mills, Inc., has informed us of their plans to seek means of treating the company's waste waters. A representative of this company has also made a statement on the company's problem.

W. J. Shea

The Town of Cumberland has obtained an engineering report on sewers and sewage treatment, recommending the expenditure of approximately $4,700,000 for such facilities. The town has more recently directed its consultants to prepare construction plans for the recommended work.

The Town of Lincoln has obtained an engineering report on sewers. The town's engineers have recommended the installation of sewers at a cost of $3,300,000. Disposal would be provided by the Blackstone Valley Sewer District Commission.

It is unfortunate that the study which forms the basis for the United States Public Health Service report, and this conference, was made at a time when no sewage treatment was taking place in Woonsocket, because a new sewage treatment plant was being built on the site of the old one. The new works were put into operation so recently that there has been no opportunity for the Department of Health to appraise their effect. This is best done in the warm, dry months of summer.

It is felt that pollution control in the Blackstone River has proceeded as rapidly as conditions permitted, and that the time is not distant when all wastes, including industrial, will be under treatment.

TEN MILE RIVER

The Ten Mile River is used as a source of drinking water supply for the City of East Providence. The City of East Providence has been advised that the Ten Mile River is not now and will not in the future become a suitable source of drinking water supply, even though all the sewage and industrial wastes discharged into it are treated. As a consequence, the city has put into motion a program for obtaining drinking water from the City of Providence supply.

The Ten Mile River was classified as regards its present and future condition, after the completion of a co-operative study made by Massachusetts and Rhode Island. Again, the classification was approved by the New England Interstate Water Pollution Control Commission in January 1956. The classification agreed to and approved was as follows:

> The present condition of the Ten Mile River from the Massachusetts-Rhode Island State line to Newman Avenue in East Providence - Class D, suitable for transportation of sewage and industrial wastes without nuisance, navigation, and certain industrial uses; from Newman Street to the Seekonk River - Class C, suitable for recreational boating, habitat for wildlife and fish indigenous to the region.

The proposed highest future use classification provided the river from the State line to Newman Avenue would be Class C, and the remainder of the river - Class B, suitable for bathing and recreation, good fish habitat, and good aesthetic value.

The United States Public Health Service report mentions the Pawtucket Dyeing and Bleaching Company plant as the only source of pollution located in Rhode Island on this river. Actually, although the plant is located in Rhode Island, the wastes from it are treated in lagoons located in Massachusetts and discharged into the river in Massachusetts. It is understood that the discharge to the river does not include any human sewage. Because the actual discharge into the river occurs in Massachusetts, there is a question as to the authority of the State of Rhode Island to act in the matter. This question must be resolved to place in the proper State the responsibility for any further action on the part of the company.

Thank you.

MR. STEIN: Thank you very much.

Are there any questions or comments?

MR. PELOQUIN: I have two questions here.

Mr. Shea, in connection with your engineering reports on Cumberland and Lincoln, do you have a construction schedule established for construction of facilities in these two municipalities?

MR. SHEA: As I understand it, in Rhode Island, before you build, No. 1, you have to get the authorization of the legislature to borrow the money.

If it happens to be a city involved, in addition to that there has to be a referendum of all the voters in the city before the money can be borrowed to start any construction. So any schedule of construction is dependent upon getting over these two problems.

In the case of the towns, it is a matter of legislative authorization of the bond issue and approval of a financial town meeting of the bond issue instead of a referendum.

With cities, it is a city-wide referendum.

MR. STEIN: This is meant for clarification, Mr. Shea.

How does that differ from any other State that sets a schedule, except your legislative operation that we are familiar with in the New England States?

Generally, when a State sets a schedule for a community that is dependent on a bond issue, it has to go before the voters, but it seems to me that that has never deterred most State agencies from setting the schedule.

How do you know when to put it before the voters?

MR. SHEA: All I can say is that any community that hasn't gotten the authorization to borrow the money is hardly in any position to build anything, or even to promise to build it.

MR. STEIN: I am not arguing with you. I think we certainly agree on the basic proposition that unless you have the authorization to borrow the money, you can't borrow the money.

However, most State agencies, in setting up a schedule, set a schedule that financing has to be arranged and construction completed by X date, financing by X date and construction by Y date.

Before the financing can be arranged, it is obvious that, except in unusual circumstances -- some States have it -- either you need a vote by the city council, which is fairly rare, or, in most cases, you need a vote by the voters, as I guess you do up here.

But I think we recognize in pollution control that any action taken by any public body, Federal or interstate, in the last analysis, when you need money, it is subject to the will of the voters in that area whether they are going to make the money available or not.

MR. SHEA: I am not sure that I made it clear, but in these two towns, Lincoln and Cumberland, there are now no municipal sewers.

These expenditures I have spoken of involve installing sewers, as well as treatment.

MR. STEIN: I see. They are a sewered community, but they are private, though?

MR. SHEA: The report pointed out that there were two or three mill villages in these communities where there is some sewage going overboard.

These are not municipal sewers. These are sewers that the mills made a hundred years ago, perhaps, and now they don't even own them at all. They sold the mills. They sold the houses. Nobody knows who owns the sewers, as a matter of fact. They run in backyards, and down streets, and so forth, and they have a very limited coverage, but before those things can be taken care of, these communities will have to be sewered, and these communities do have, at least, tentative plans for installing sewers.

That is all I am trying to point out.

MR. STEIN: All right. That clarifies it.

MR. PELOQUIN: I have one other question I would like to ask, or one point I would like to clarify, and I think this may be addressed to Mr. LaRiviere rather than you.

I note in the classification of the highest future use, I don't detect the D classification insofar as the highest future use is concerned, and I know that the Public Health Service report did not cover that also. However, in the schedule which was attached to Mr. Taylor's presentation I noticed that from the outlet of Steel Mill Dam at Greenwood Street, Worcester, to the inlet to Fisherville Pond at Pleasant Street in Grafton, it is now Class E to a future highest of Class D.

There was another which I happened to notice which was a D and remains a D.

Is this a typographical error, by any chance? The present condition I recognize as being D.

MR. STEIN: I think I have the same question. I was going to leave that for the discussion.

For example, if you don't mind --

MR. SHEA: I think the wrong man is up here.

MR. STEIN: Your top one comes to Class D from the outlet of Steel Mill Dam at Greenwood Street.

MR. SHEA: That is up in Worcester.

MR. STEIN: You both have identical problems, sir. You have one here too that has to be clarified, this one from Newman Street in East Providence, Class D.

Is that going to remain Class D, or will that be C, from the Massachusetts-Rhode Island State line to Newman Street in East Providence, Class D? That will be upgraded to C?

MR. SHEA: To C. Yes.

MR. STEIN: In other words, what they call your future highest use will be Class C for all waters of the Blackstone and the Ten Mile Rivers. Is that correct?

I think we will have to settle this before we can go on.

MR. SHEA: Let's take one river at a time.

MR. STEIN: How about the Ten Mile?

MR. SHEA: All right. We plan the Ten Mile to be placed in C and B towards the mouth.

MR. STEIN: Now, how about the Blackstone?

MR. SHEA: All right. Now, on the Blackstone --

MR. STEIN: Yes, sir.

MR. TAYLOR: On the Blackstone --

MR. STEIN: Wait just a minute, please.

MR. SHEA: When we get into Rhode Island on the Blackstone, the new one --

MR. STEIN: Yes, the new one we are talking about.

MR. SHEA: It is C and we hopefully will go to B.

MR. STEIN: But it is never going to be over C?

MR. SHEA: Right.

MR. STEIN: I think we are set there.

While we are on this, how about Massachusetts, sir?

I call your attention to these two specific ones:

From the outlet of Steel Mill Dam at Greenwood Street, Worcester, to inlet to Fisherville Pond at Pleasant Street in Grafton.

There was one more.

MR. TAYLOR: That is correct.

It is our opinion, with the present state of knowledge for the industrial treatment of mills for Worcester and the limited dilution that is available in that area, we cannot provide a water of C classification.

MR. STEIN: All right. Let's get down to this operation. I thought we were in agreement on this. This statement has to be modified in our report.

I am reading from the Public Health report, Summary 3. It says:

> "Although the Blackstone River and the Ten Mile River in the region of the Massachusetts-Rhode Island State line are considered Class D on the basis

"of present water quality, both have been assigned a Class C for future highest use by the New England Interstate Water Pollution Control Commission."

Now, I understand, Mr. LaRiviere, that you had said the same thing.

MR. LA RIVIERE: Yes. In other words, this is the area of study right there.

MR. STEIN: The statement I read did not have any limitation.

MR. TAYLOR: It says in the vicinity of the State line.

MR. STEIN: Let me ask this question:

I wish the man who prepared our report would listen to this, because he may be able to resolve this.

Would you think that this classification, Class D, would have any material effect on water quality at the State line as far as Class C, or possibly an interference with health or welfare, if the water at the State line were Class D?

MR. PELOQUIN: I think Al West may be in a better position to answer that, because he actually did the survey on the stream.

MR. STEIN: Mr. West, will you come up again, please?

MR. WEST: Yes, sir.

MR. STEIN: As I understand it, the proposal is for the best future use of the water in the vicinity of the State line to be at least Class C generally?

MR. WEST: That is my understanding.

MR. STEIN: There is a little stretch that we talked about here from the outlet of the Steel Mill Dam at Greenwood Street, Worcester, to the inlet at Fisherville Pond at Pleasant Street in Grafton, where they intend to leave that in Massachusetts as Class D.

Would that have any effect on Class C water at the State line? If it will not, I would suggest that we can get on with our business.

MR. WEST: Mr. Stein, just because it is left as Class D is not a positive indication that it would affect pollution.

MR. STEIN: No, I don't mean that.

The only interest we in the Federal Government have is pollution at the State line going across the State line, and going from one State into the other.

MR. WEST: Yes.

MR. STEIN: Whatever the condition of the water was in a single State -- and I don't say this is good or bad -- but however deplorable you might think it is, under a case of this kind this is a State's concern.

If this does not have an interstate effect, we should accept this and go or with our problem at the conference.

MR. WEST: I do not think it will have an interstate effect, because we hear of improvements to be made, and I believe that the improvements to be made at Worcester, although they may not be sufficient to bring it up to the local streams, will have taken enough of the pollution out so the effect no longer will be an interstate problem twenty-some-odd miles down below, as long as they do carry forward this program of improvement that we hear about.

MR. STEIN: All right.

MR. LA RIVIERE: You have the State committed to a Class C at the State line anyway.

MR. STEIN: Yes.

There is another Class D. That does not affect it either.

MR. PELOQUIN: That is on the Ten Mile River.

Let me ask Mr. Taylor one more question.

This would not be a Class D, meaning the classification of the water, similar to what we had on the Chicopee affecting the dissolved oxygen?

MR. TAYLOR: There are several reasons because of which this water must be classified D rather than C.

This is not one entirely of dissolved oxygen. There is appearance, for one thing, that makes it a D stream. From the appearance, we cannot make it a C stream.

MR. STEIN: We understand the apparent problem. By the way, we would like to help, but you recognize this is an intrastate problem.

Now, let's see if we can clear this next point up and then we can move on.

On the Ten Mile River, you have one Class D from North Attleboro-Attleboro boundary line to the outlet of Farmers Pond.

Do you intend to keep it in Class D?

MR. TAYLOR: This, I am sure: from what has happened on the operation, or what will happen on the North Attleboro treatment plant, it is my opinion that that will very readily go to C.

I do not think that we will maintain that, and I am sure we will not maintain it in a Class D.

MR. STEIN: Yes.

MR. TAYLOR: Although it has not been officially classified for the future as C I feel sure that there will be no difficulty in maintaining it in at least Class C.

MR. STEIN: All right. I think we have agreement, don't we, gentlemen, that the water will be in the Class C in the vicinity of the State line?

MR. TAYLOR: That is correct.

MR. STEIN: All right. I think that clears that up.

I would like to set something up here, and this is largely for the record:

When we come to these conferences, the Federal representatives are prepared to stay here as long as we have to. This is our job. This is our duty, and this is our function. We are prepared to go into the discussion and try to see what agreement we can get and summarize only when the State and interstate agency representatives feel that they are sufficiently familiar with the material, that they have absorbed what has come in here and analyzed what has come in, and are ready to go on.

I think it should be recognized, as seems to be apparent from the State, the interstate and the Federal level, we are all of us not looking at this problem for the first time today. As a matter of fact, as you can guess at least from the State people, they have lived with this problem intimately for a long, long time.

I would like for the record to poll the conferees and see if they are ready to go on with a discussion, and see if we can come to an agreement.

Mr. Shea, would you want to push on with this?

MR. SHEA: Yes, I would.

MR. STEIN: Mr. LaRiviere, would you?

MR. LA RIVIERE: Yes, go ahead.

MR. STEIN: How about you, Mr. Taylor?

MR. TAYLOR: I do.

MR. STEIN: And Mr. Peloquin?

MR. PELOQUIN: I would just as soon go right through to completion.

MR. STEIN: All right.

MR. TAYLOR: I would suggest we might have a five-minute recess.

MR. SHEA: Yes.

MR. STEIN: All right. We will get up and stretch for about five minutes, and then we will reconvene.

Don't go away, because characteristically, the next part is the most fun.

(Whereupon a recess was had.)

Closing Statement - Mr. Stein

MR. STEIN: May we reconvene, please?

In order to expedite matters and try to save as much time as possible, we will see what areas of agreement we can come to among the conferees, and see where we can come out.

First, it can be agreed that both the Blackstone River and the Ten Mile River are interstate rivers within the meaning of the Federal Water Pollution Control Act, as they cross State lines. This seems to be obvious from the statements of all concerned, and there certainly cannot be any dispute with geography.

As to this second point, I don't know the agreement we are going to come up with, but I think at least the Federal report indicates that the Blackstone and Ten Mile Rivers, because of the municipal and industrial waste discharges, have water quality conditions indicating an interference with the river for recreation and fishing, and create a condition which constitutes a health hazard for water contact sports, create an offensive appearance, and create unpleasant odors.

Is there any disagreement so far?

MR. TAYLOR: Mr. Stein?

MR. STEIN: Yes.

MR. TAYLOR: I will agree that there is an effect as far as water quality, but will not agree that there is a condition which is detrimental to the health and welfare of the citizens of my sister State.

MR. STEIN: Yes, I understand that, Mr. Taylor. I did not say that yet. That was the next point.

However, after all, the river is in Class D.

MR. TAYLOR: What I meant to say was I think that these other conditions of which you speak, namely, fishing, appearance and recreational bathing and such, are the items that are classified under "welfare."

When we come to speaking of the health and welfare --

MR. STEIN: Health or welfare.

MR. TAYLOR: Health or welfare, these two I would like to disagree with on the basis that they are not germane to the subject, because if you have water that is six inches deep, you don't swim in it, regardless of its quality, and you do not go water-skiing in areas of the size and the configurations and such of the depth of the Blackstone River.

Thus, I do not understand that this is detrimental to welfare as far as quality is concerned.

The river itself was not made for these things, and in my opinion, at least as recorded here, it must be that this is not detrimental to either the health or the welfare.

MR. STEIN: I understand that. By the way, we did not get to that yet, but when we bring it up, I think you will recall the statement of Mr. Schrader from the Fish and Wildlife Service about the fish, or the possibility of the fish coming up.

Water contact sports are inevitable. We have had the same thing, talking about any other river from the Mississippi and the Missouri all the way through the country. You have the same thing on the shores of New York City in Jamaica Bay.

There isn't a police force big enough, or there aren't enough signs to keep people away from coming into contact with polluted water once you get a river going through it.

I was brought up in New York City and, even when I was a kid, the kids used to dive into the East River. Goodness knows, at least my mother would have probably committed me to an institution if I ever did that. You just can't keep people away.

We recognize this difference of opinion. I think what you are saying is that this does not endanger health or welfare of persons in another State. Our people say that it does.

Do any of you other conferees want to associate yourselves with either or neither of those positions?

What we are attempting to do is to get the opinions and summarize them. We are not telling you what to say, and, obviously, what we summarize will be what you do say.

MR. SHEA: Let me make this comment.

MR. STEIN: Surely.

MR. SHEA: I have one difficulty, because you are talking, if I understand it, about a condition of the river which doesn't exist any more, because you have sampled it with all the sewage that we were talking about going overboard when there was no treatment. You have sampled it when quantities of waste from the Branch River Wool Combing was going overboard, which no longer exists.

Now, how can we deal with that situation?

MR. STEIN: In other words, you are saying we have a clean river now.

MR. SHEA: I am saying that we don't have the same river we had when it was studied.

MR. STEIN: Mr. Shea, with all due deference, I wonder if this river isn't substantially the same.

MR. SHEA: I hope it is better, since so many millions of dollars have been spent to improve it. I hope it did something.

MR. STEIN: One of the problems we always have is getting pertinent information before anyone considering pollution problems. A river, you know, is like a zoo. The zoo isn't the same every two days you see it. Some animals are born and some animals die.

The point is that the State agencies and interstate agency very properly want to see our report enough in advance, and if you do that, then there are changes.

I will never forget the time, Mr. Shea, when we were invited into a State to help them out with some oil pollution cases.

After working day and night, we went out and got the evidence and went before the judge. The case was before the Court on Friday and we gave him what we thought was this horrible evidence of pollution.

He said, "When did you examine this?"

We told him, "Wednesday."

He said, "How do you know it still exists? Case dismissed."

MR. SHEA: Well, you wouldn't want to say that we put up a new sewage treatment plant every month, every year, or every two years on the Blackstone River.

Here is a case where the thing was almost completed, and you are out sampling the river with everything going overboard. As I understand it, the same thing was happening in the Ten Mile River as far as Attleboro is concerned. Is that right, Mr. Taylor?

MR. TAYLOR: Yes.

MR. STEIN: Would you say that the river, at the State line, is in a C classification now?

MR. SHEA: I don't really know what it is, but I hope it is something different from what it was when you made the study.

MR. STEIN: What would you say, Mr. Peloquin? Do you think the river is substantially the same?

MR. PELOQUIN: I am inclined to feel that there should be a considerable amount of improvement, but I don't think anybody can say that it has actually achieved a C classification without actually going out and sampling it again.

MR. SHEA: Next summer.

MR. STEIN: Well, we can say during the period of our survey, this was indicated.

MR. PELOQUIN: That's right.

MR. STEIN: All right.

MR. LA RIVIERE: One thing that you can say is that the timing of the survey was very poorly selected.

MR. STEIN: The timing of this survey was selected by our scientific staff, as far as I know, the way any other survey is.

Was this done during the summer months?

MR. TAYLOR: Yes.

MR. STEIN: This is one of the problems we always have with our scientific staff. They always tell us you have to survey the New England streams during the summer months, because that is the critical point. You have mentioned the summer again, where you have dry weather and low flow.

I am glad there is a scientific basis for that. I always thought it was because they liked to be up here during the summer.

MR. SHEA: No. I think your scientists are on firm ground.

MR. STEIN: This is why the survey was made at that date. It was not done with anything else in mind, other than the general climatic conditions that our scientists indicate to us should be present in a survey.

MR. LA RIVIERE: Well, I didn't particularly have reference to the time of the year.

Why were the Blackstone and Ten Mile selected, for example, when two major sewage treatment plants were under construction?

MR. PELOQUIN: This is the Secretary's decision. I don't think it is a decision as far as the survey or the staff is concerned.

If the Secretary says he would like a conference on this particular stream, he may or may not be aware of what is going on in the stream. I think this would be the governing factor.

MR. LA RIVIERE: Well, I think the Secretary needs to be better informed.

MR. PELOQUIN: We are trying to do this with our summary reports, and I think we are achieving some degree of success. I hope by the end of the year we will be completely successful.

MR. STEIN: If you will permit me, based on what I have heard here today, I don't know that the Secretary was ill advised in selecting this.

I do think, though, that selections of rivers are made relatively on a mechanical basis by the Secretary. His job is to survey every interstate river, and he does that methodically.

Closing Statement - Mr. Stein

We have, in the past, gone in and heard the same story as we have today.

"Unfortunately, when you got here, our sewage treatment plant wasn't working," or, "We were by-passed."

It is the rare survey that we don't come up with a situation like that.

"If you would only come next month, or next week, things would have been working fine."

This is a constant refrain.

The problem with our investigators is that they always seem to come just before something happens, or while they were just by-passing the plant. The difficulty with that is that this is so indigenous, and it happens in almost every river they go into throughout the country.

I appreciate your remark, but I think there is no disagreement as to the condition at the time that they made the report, and the notion that we believe the river is substantially improved because of these facilities which were put in, or should be substantially improved.

MR. LA RIVIERE: Well, with the exception that we might be talking about a different set of circumstances.

Should the river or the two rivers have been surveyed, let us say, in the summer of 1965, and this conference had been held in January of 1966?

Closing Statement - Mr. Stein

MR. STEIN: Again, let me point out that this is the profession that you have.

I am not going to raise a point on the field surveys here, but I do suggest this: I have been at least to one of your interstate meetings. I have looked at your surveys. I have watched other States. I have watched our people.

The way the profession generally makes the survey is that this is about the kind of time schedule you get, give or take a few months. That is, they go out for a couple of weeks, or a month, and gather the field data.

Then they come back to the laboratory. They analyze the perishable samples pretty rapidly. They analyze the other samples after a while.

After the laboratory analysis, you go through mathematical analysis. Then you go through your review. Then they put the report together and your people look for bugs in it.

Maybe the whole establishment is a creeky one, but I don't see that there was any unusual delay between the time of the survey and the actual material.

As a matter of fact, sir, if I may point out, I think what we have done is that we have more up-to-date data, and we have gotten constantly more up-to-date data than we certainly did when I started out in this business a while ago.

I was appalled to find out that we used to move ahead and make judgments, say, in 1952, on a survey done in 1938 or 1939.

The point is what we try to do is get an actual field study done within a reasonable time before the action has taken place.

MR. SHEA: Mr. Stein, if I may make this comment?

MR. STEIN: Yes.

MR. SHEA: I am ready to agree that some improvements need to be made.

MR. STEIN: Yes.

MR. SHEA: I don't know why we have to haggle over these things.

MR. STEIN: I agree with you.

MR. SHEA: Don't ask me to agree that a river is a thing it was six months ago and is no longer, but if you want me to admit that there are things that need to be fixed, I agree.

Why don't we proceed on that basis?

MR. STEIN: Thank you.

MR. SHEA: For whatever reason they need to be fixed, they ought to be fixed, and there are reasons.

MR. STEIN: But at the time the report was made, presumably it reflected this condition.

MR. TAYLOR: Mr. Chairman, I suggest if we do it on that basis, that we make a statement of the condition as of the time of the survey, but make note of the fact that there have been certain changes for the betterment in the interim period.

MR. STEIN: Yes. I think the transcript will indicate that this has been done, but we will certainly take that reiteration and we will do that.

I think cognizance should be taken too of the fact that at the time the report was made, the Blackstone River and the Ten Mile River in the region of the Massachusetts-Rhode Island State line are considered Class D on the basis of their then existing water quality, but cognizance should be taken of the fact that the States involved of Rhode Island and Massachusetts, and the New England Interstate Water Pollution Control Commission, have assigned a Class C to these waters for future highest use. They have a program to put this Class C into effect.

MR. TAYLOR: I would agree with that.

MR. LA RIVIERE: Right.

MR. STEIN: I think we have covered as much as we can the agreements, the occurrence of pollution subject to abatement under the Act, and the adequacy of remedial measures.

As Mr. Shea has stated, as of this time there is room for some improvement. I don't think the full program as both States have outlined it has been met, and I think that adequate remedial measures are not yet installed.

MR. TAYLOR: Have not been.

MR. STEIN: Have not been installed.

MR. TAYLOR: I think you must recognize that there is an adequate program for abatement, albeit that it might not have been adequately expressed.

MR. STEIN: All right, we will come to that. One thing at a time.

The next point, I think, is the nature of the delays, if any, in abating the pollution. I don't know that there have been, given the situation, any undue delays.

I would say that the reason these remedial measures were not put into effect and the pollution has not been abated is because of the very complex nature of the problems, as you have heard expressed here today, and the notion that no State or community or interstate agency, or the Federal Government, for that matter, has been able to tool up and solve a pollution problem overnight. These things take time. The States have had a program towards this pollution abatement.

I think that we can agree -- but let us see if there is any disagreement -- that the substantive analysis of the plans of the municipalities and of the industries that there have to be some improvement of, have been outlined in this report, and have been agreed on by the States and the interstate agency.

How about the Federal Government?

MR. PELOQUIN: Right.

MR. STEIN: There is no disagreement as to what should happen.

We have had the programs of the States here put forward as to where they intend to move with the existing communities and industries.

Except in an instance or two, as outlined by Mr. Taylor, four Massachusetts communities, there has been no terminal date for construction to be completed, as I understand it.

MR. TAYLOR: There have been several where there was a terminal date, but there are others where the terminal date cannot be set at this time.

MR. STEIN: Yes, but I don't think any were set from Rhode Island. Two were set from Massachusetts.

MR. TAYLOR: I don't think we have any real problem in this area of setting a terminal date, because these communities are not now legally creating problems with pollution. What Walter is doing is forestalling the date when they will have problems with pollution by installing a sewerage system, whereas now --

MR. STEIN: No. I am talking about the industries.

MR. TAYLOR: I think he only has one or two.

MR. STEIN: Let me make this clear from my point of view, and I don't know if you would agree with it.

I would say certainly those two little communities you talked about should be cleaned up.

I recognize the difficulty, and I think we all do. We recognize the difficulty in dealing with situations of that kind.

We also have to put this in perspective, and recognize the effects on the total interstate pollution situation. I think we recognize that with those you may have a very special problem.

MR. TAYLOR: I would like to suggest that we not even consider those two communities that we are here concerned about, because they are not even mentioned in the Federal report, if I remember correctly.

MR. STEIN: Is that agreeable with you?

MR. PELOQUIN: Agreeable.

MR. STEIN: All right.

By the way, there are several other communities which seem to have put in their treatment works that appear to be in good shape.

Is the Mayor of Attleboro here?

MR. TAYLOR: Yes.

MR. STEIN: Do you want to include in the summary that you people all consider he has adequate treatment now?

MR. TAYLOR: No. There is adequate treatment for the wastes that are now collected, but he will have to make other connections to the sewerage system.

MR. STEIN: All right.

MR. TAYLOR: Please don't say that everything is rosy.

MR. STEIN: Yes.

MR. TAYLOR: Because there are local problems there that must be solved, and if it should appear in the record that everything is done, there will be no opportunity to get --

MR. STEIN: I recognize that.

MR. TAYLOR: There are local problems, although they are small, that must be handled in those communities.

MR. STEIN: What were the names of those two communities?

MR. PELOQUIN: Lincoln and Cumberland.

MR. STEIN: Can we say that this was not included in the Federal report?

MR. PELOQUIN: This would be a case of intrastate pollution.

MR. STEIN: We sometimes have a problem here on the balance of equities business. That is, you can't really ask a State to clean it up if a downstream State is going to clobber the devil out of the water as it gets across the State line. However, I don't think those two communities fall into this kind of a category. I know what your problems are with them.

MR. TAYLOR: We have no objection to that.

MR. STEIN: All right. Let me get off the record here.

(Discussion off the record.)

MR. STEIN: May we go on with this schedule of the other specific industries and communities or cities that need treatment?

I wonder if we could try to see if we can at least clarify the feeling of the conferees on when this can be done.

We have a pretty full statement of your views, Mr. Taylor. I think Mr. Shea's views are expressed. Philosophically, they were about the same. I think his problem is smaller, because they have less communities and industries that have to put in treatment.

However, I wonder if there is anyone else who may have had some notions on what an appropriate time or schedule for a clean-up would be.

MR. PELOQUIN: Well, I recognize that there are problems. I have had experience in municipal management, and I can say that I can sympathize with the municipalities in this respect also.

However, in any program, I don't see how we can achieve the goal unless we do have a time-table setup or a schedule established.

I concur with Mr. Taylor's schedule as it is prepared and submitted in the statement, but I feel that it should be expanded to include construction, because actually I don't believe pollution will be abated or the conditions will be alleviated until construction has been completed.

The latest date which is shown here from the standpoint of completion in the reports is about July 1966.

I would like to suggest or propose to the conferees that the regional office be advised upon completion of the various engineering studies, and that we would like to see construction initiated within ninety days after completion of the study, with all pollution abatement facilities, waste treatment facilities, completed by January 1, 1969.

I feel this is a realistic schedule, and would give everyone concerned a goal to work towards to provide a real basis for achieving cleaner water.

MR. TAYLOR: Mr. Peloquin, I can't agree with you.

I know what you are looking for. I wish that I could do the same.

On this matter, when we are having a study made, it is true that we don't know when Federal money will be available for the completion of the study.

At the end of the study, which in no instance has been more than twelve months that has been allocated, we tell these communities beforehand that the study that they are undertaking must include an overall program of what needs to be done, and a schedule of costs for each portion.

The reason for putting into this the schedule of costs is that under the Massachusetts law, no municipality may be required to abate pollution unless it has the ability to pay, or, that is, to finance the construction that is recommended. This is in Massachusetts law, so that if the program for pollution abatement amounts to more than the ability to finance, this means that it cannot be completed on orders of the Commonwealth of Massachusetts, and the only way that it could be accomplished, other than agreement of the community that they will buckle up and they will do more than is required by law, is for the Federal Government to come in and actually do the enforcement on the program.

I am not sure whether that would be effective or not, but I can tell you that in my estimation --

MR. STEIN: We would much rather have you do it.

MR. TAYLOR: -- that it would be delayed because of the nature of court action and things of that kind, and we would have nothing but a slowed-up and an uncooperative program, which we are not looking forward to.

We would prefer to wait until the study is completed, and then say that within ninety days of the completion of the study, we would advise you, or we would agree with the community as to a program for the completion of the second or third stages of the program.

The second stage, under these circumstances, would be a completion of final plans for the program. Upon completion of the final plans, or by the time that this was done, we would have agreed with the community on a schedule for construction.

Now let us go back to what has been done on the

Merrimack River. To date, every town on the Merrimack River is up to schedule, with the one exception of the City of Lowell, and the City of Lowell is behind schedule because HHFA has refused to give them the money, or to loan them the money on the study program.

But every community has a study underway. One community voted last week to go ahead with the construction of pollution abatement facilities.

Another community is going to vote in March on their going ahead with the second phase of this program, so that we are getting a very cooperative and progressive study and abatement program in operation on the Merrimack River.

If we go here and independently have those communities set a date, I think they are going to rebel.

If we can sit down with them and determine when these dates will be, without them reading it in the paper ahead of time as to what we have decided, we are going to get an awful lot better cooperation, and the program will be in effect several years ahead of what it would be if we went into an uncooperative situation that may arise from reading in the paper what has been decided for them.

They might be led to this thing much easier than we can expect to push them.

I would suggest that the change in the program of Massachusetts be that we would come into this phase of decision ninety days or three months after the completion of the study.

The Federal program now, which I believe would be the Public Health Service rather than the Secretary of Health, Education, and Welfare, requires us to report to you every six months the status of pollution abatement programs in any area in which that has been accomplished.

MR. STEIN: That is the Secretary of Health, Education, and Welfare.

MR. TAYLOR: Regardless of which one it is, a copy goes to HEW anyway.

MR. STEIN: Yes.

MR. TAYLOR: And thus it is that you have before you a continuous report, at least every six months, of what has been done by every community and every industry mentioned in these conferences, and it seems to me that this is adequate assurance that there is going to be a continuing program and that you are adequately advised of it.

As far as Mr. Peloquin is concerned, there is close enough cooperation between the regional offices and the State agency, so that we would have no hesitancy in discussing the programs or the plans as they come in to us for approval.

Any time that you people wish to see them, you are entirely welcome to see them, and we will be glad to discuss with you the adequacy of the program.

MR. STEIN: I think you are fairly close. Let me try to summarize this and see if I can clarify it.

You will prepare a report every six months?

MR. TAYLOR: Yes.

MR. STEIN: Do you put in additional reports three months after they come to an agreement, or do you wait for the six months?

MR. TAYLOR: We wait for the six months at the present time, but we have no hesitancy in calling you people in and letting you sit down with us when we discuss the dates, if you want to.

MR. STEIN: At least, for the basic part of this operation, I don't think there is any substantial disagreement between the first two parts, that the reports be made on these issues every six months, as you have done in the past, with the notion that after studies are completed, within three months you will have established an agreement for a construction schedule.

MR. TAYLOR: A schedule for the next phase.

MR. STEIN: Which is what?

MR. TAYLOR: Which is, if we are in the first stage where we are making preliminary studies, that we have agreed on what is necessary for the final construction stage, and we have set up in that a time schedule for the procurement of the land.

The reason this must be is because you cannot get an HHFA loan for final construction plans unless you own the land or you have complete and final options on it, I believe, or at least you can't get paid for it, so that we would encourage every community in this three-month period to procure the site that has been recommended in the preliminary plan, and arrange their financing, or any financing that may be necessary at that preliminary date for the final construction plans.

This time for construction plan preparation is set by HHFA, and then it is our opinion that the next step should be taken at the next annual town meeting.

We do not like to have come up for discussion the construction of a sewage treatment plant at a special town meeting, where there may be a dozen people present, because under those circumstances, everybody who comes is coming because they have something to oppose, and those who are in favor of it will not get out on a night like that to vote in favor of it; but every person who is opposed will.

The only logical time to do it is at an annual town meeting, when there are enough items on the town meeting agenda so that you will have a representative population out to vote on this thing.

The next step that should be taken following the annual town meeting, after the plans are fully prepared, is construction, and at that time it will be our statement that they must take action at that time, or we would be prepared to go ahead to take legal action to make them comply.

At that time, if the engineers tell us it is going to take one year, or it is going to take six months, or going to take three years, to build the plant or the facilities involved, we would take that into consideration.

In the City of Worcester, we have two things involved here. One is a major separation of sewers in the central part of the city, which is a part of the pollution and abatement program. This may take a matter of several years for construction, because of the disruption of traffic. It is going to take a long time to do it.

We also have a rehabilitation or an expansion of the sewage treatment facilities, which will not take anywhere near as long.

However, this Worcester situation is complicated by another factor. I just want to show you the complications in this matter.

Closing Statement - Mr. Stein

You have heard mentioned many communities on the watershed of the Metropolitan District water supply. Those communities cannot provide a sewerage system with an effluent from a sewage treatment plant within their boundaries, because all of their land rests on the watershed of the Metropolitan Water Supply District, and the effluent could go no place except into the drinking water supply, so that in order to make a regional plan and an adequate plan, those communities must for a region and discharge their sewage through the Worcester sewage treatment plant.

This means that in all of the planning, we have to take into account this matter of the other communities, and until they form this region, it is quite probable that the City of Worcester will not provide funds to build the plant in anticipation that they will go ahead with the area, so that it must be a flexible plan.

As far as I am concerned, it must show continuing progress or you call -- what is the next step?

MR. STEIN: A hearing.

MR. TAYLOR: -- a hearing on the thing; but as far as this conference is concerned, I think this is the reasonable way to approach it in the matter that we set the first date first, we allow so much time for consideration for the second step upon completion of the first, and then we allow this period for construction following that.

I do not think that we are justified at this moment in stepping forward over all these intermediate steps, to a final completion date.

MR. PELOQUIN: Let me make one more comment here.

As far as a completion date is concerned, it is not my intent to pinpoint any one municipality to a specific date, but to strive for a target date station-wide, say, 1 January 1969, which would allow flexibility within the four-year period.

MR. TAYLOR: I am afraid that this is going to delay things.

The moment that we set a date in 1970 or 1969, someone is going to say, "Why do I have to go now?"

Let us not set that kind of a date, and let us try for the earliest and most practical, and not sort of tie our hands by saying we are really going to be looking for you to get it done before 1970.

MR. STEIN: Let me just make a comment on that.

I do think your programs on the Merrimack and on the Connecticut are moving along rather well, and you have used both types of operations.

But, as a general point, I have never seen one of these dates set up where someone said, "You set up this date and you are going to delay us," and that date has actually had a delay.

MR. TAYLOR: I can tell you one.

MR. STEIN: Which one?

MR. TAYLOR: The City of Chicopee. Chicopee was in the office the other day, and they said that as long as we set a date as to when they were going to start, they would say, "Nothing doing, and you can take us to court."

MR. STEIN: You mean any date.

MR. TAYLOR: Yes. But what I am saying is, the moment that we said we would not set a date, but let's go ahead as fast as we can on it, they went back to their town fathers and voted to go ahead.

MR. STEIN: This is another point. That is as long as you set any date.

I can recall one big Midwestern pollution situation where we had a tremendous city on one side of the river and a lot of little communities on the other.

The State representing the communities thought the date we set was ridiculous. The big city has passed one of the largest bond issues in the United States, and is moving, whereas some of the little towns are just about getting going.

I have never seen a cut-off date go over, but let's get to Mr. Shea on this.

Is it agreeable to you at least to go down to the point where we will have a six-month report, and an agreement on the next phase within three months after the first reports are in? Is this a fair statement of your position?

MR. SHEA: I don't know how I could dodge that one.

MR. STEIN: All right. I think we are very close together. We can leave it this way, because I don't think we can go on with this.

If it is Mr. Peloquin's notion that all construction should be completed by January 1, 1969, we can record that as his view.

If it is Mr. Taylor's notion that we should leave that construction date flexible, we can record that.

Perhaps Mr. Shea has another point of view.

I would like to point out that there was a date set up in the Merrimack conference recommended by the Federal conferee there. There was also a date recommended by New Hampshire, 1983, one year off from George Orwell's "1984," and Mr. Taylor of Massachusetts made another recommendation.

The Secretary, when he sent out the conference summary, accepted, as I recall, the recommendation made by

Massachusetts, didn't he?

MR. TAYLOR: Yes, but I think also that New Hampshire feels that he accepted theirs also.

MR. STEIN: I would suggest that New Hampshire read it.

MR. TAYLOR: This is not the forum to discuss this.

MR. STEIN: Let's go off the record.

(Discussion off the record.)

MR. STEIN: All right, Mr. Shea.

MR. SHEA: If you would like my opinion --

MR. STEIN: Yes.

MR. SHEA: I don't think the setting of dates is very realistic or very important.

I think you get these things done by keeping pressure on the people, a constant pressure, bringing them in regularly to find out what they are doing, and so forth.

I even have a great distaste for setting a date five years from now, or four years from now, to build something. I think in many cases we get it done before that.

MR. STEIN: I am sure you will.

MR. SHEA: And I think when you set a four or five-year date in the future, it kind of removes all the urgency from that, from the proposal, and if you will tolerate four years, you are likely to get ten years.

MR. PELOQUIN: I will be very happy to advance the date if it will help the cause.

MR. STEIN: By the way, I don't think that happens. As a matter of fact, I know that this happens: Since last summer's survey, some really significant work has been done.

MR. SHEA: If you look into the records of pollution control in Rhode Island, you will find where one of our cities was ordered to have plans to get things done, and was ordered and re-ordered for a period of ten years, and they never did anything.

MR. STEIN: I understand that. This is possible.

MR. SHEA: That has happened all over New England, I think. You can get examples of that every place.

MR. STEIN: I think in the areas where we have had some of these conferences in New England, there is no doubt about that. New England is going ahead. The interstate agencies are there.

However, I think we have to recognize, as Mr. Taylor pointed out, that if this does not work the Secretary has an obligation to go to the next stage in the hearing.

The point is that someone has to make a judgment whether this is going to work or not, and, presumably, it is very difficult unless a guideline is set for this to go.

I think we are reasonably set on what we have come to do with the conference. It is up to the Secretary to make a recommendation on what he wants. If he makes it on this point, fine. If he does not, all right.

MR. TAYLOR: Could I make a recommendation for you to consider in making our recommendations to the Secretary, and that is that the conferees agree that this should be done as early as is practical?

MR. PELOQUIN: Yes, I agree to that.

MR. STEIN: All right.

Mr. Shea, Mr. Taylor has indicated, which was perfectly agreeable to us, that we make a recommendation to the Secretary that any remedial work be done as early as practicable.

MR. SHEA: I think it is reasonable to have the first step at a deadline, and then I think you can go ahead. You creep before you walk and you walk before you run.

MR. STEIN: We really don't have a first deadline set.

MR. SHEA: Before you have a plan, you don't know how much a thing is going to cost, or whether the community can even undertake such or not, do you?

Closing Statement - Mr. Stein

MR. STEIN: Very briefly, I think the communities that we are concerned with in New England, again, and I know I talked to you about this, as compared to other communities in the United States --

MR. TAYLOR: Don't put this on the record.

MR. STEIN: You can put this on the record -- oan afford this.

I think in New England, as Mr. Taylor points out, you do have certain financial positions up here on this business of a city being able to afford something. In other parts of the country, where they have the revenue bond and sewer service charge system, communities not as well off as yours, or certainly no better off, consider this well within the scope of their ability to pay.

The way I feel about this is that you cannot afford not to do that.

If you will just give me another minute, what you have here are two beautiful rivers, or potentially beautiful rivers, the Blackstone and the Ten Mile, going into a beautiful bay there, and all these water facilities.

If you have ever been out in the seventeen Western States, where they don't have any water, where it dries up, if they had rivers like you have, they would pay anything to have clean rivers flow by their doors.

It is just a question of having this and having so much water here that you don't recognize it. Again, I say I know the regional differences. It isn't as judicious to put out the kind of money that people do where water is scarce, but I do think you cannot afford not to do it.

MR. TAYLOR: May I say something off the record?

MR. STEIN: Yes.

(Discussion off the record.)

MR. STEIN: Do we have any other points to cover before we adjourn?

MR. TAYLOR: No.

MR. STEIN: I do think that we have made excellent progress in this conference. I do think we have delineated the situation.

I think you will find that pollution problems are complicated and they change very, very rapidly. We do have some really complicated problems, which were just alluded to by Mr. Taylor. One of the little rag-tail problems is those little communities talked about by Mr. Shea.

The question of combined sewers and separating combined sewers is a very, very difficult one that has to be met, but I do think that we do have a program, and the

States and the interstate agency here do have a program underway which I am confident will do the job.

I do think that Federal assistance and help -- and I view a conference such as this as much help as I do technical assistance and financial assistance, although some may not agree with that -- with Federal help and State and local help we are going to solve the problem.

The problem, as you can see, is so complex and so great that it is going to take, in my opinion anyway, every level of government to work on this to try to come up with a reasonable solution. Also, we are dealing, again in my opinion, with one of the touchiest and most difficult problems and areas in the latter part of the Twentieth Century in America. That is the Federal-State-local relationships, and interstate relationships, particularly when you are dealing with a Federal regulatory power, and when the State also has regulatory power, and when both the State and the Federal Government and perhaps the interstate agencies are asking other government constituencies to do something possibly just before they are ready to do it, and nudging them along. This, as you know, is one of the most difficult problems in our time.

I think it is a credit to the professional capabilities of the interstate agencies, the States here, and the staffs of the States, starting out with the virgin philosophy and really complicated problems, that we are able to sit down as amicably as we have, and work our way slowly through a very complicated problem and come up with the tremendous measure of agreement we have achieved.

I will make a prediction on this. If there is nothing that goes wrong -- and I have full confidence in the States, given no unforeseen circumstances -- I see no reason at all that this should not be the last session of the conference on the Blackstone and Ten Mile Rivers. I would predict that within the very near future you are going to have a river where we are going to have reasonable treatment, and that this will proceed in an orderly manner.

I would suggest again that when you are thinking in terms of a complicated or a complex industrial-municipal and population concentration which we have here, that when we talk about pollution abatement here, we mean that we talk in terms of Class C water. You are not going to have a pristine mountain stream gushing by here, nor do I think reasonable men can expect it.

We have to recognize the people have to have a place to live, and industry has to have a place to operate. Otherwise, the people won't be able to live.

There is no point in having clean water if there are no people really to enjoy it. We are dealing with people, and I think we are on our way, the States and the communities and the interstate agency, to a cleaner Ten Mile River and Blackstone River.

I do believe too, and I hope the interstate agency will agree with it, that the basic day-to-day operations in dealing with the cities and the industries involved and dealing with the financing, approving of the plans, and all other related activities, in getting construction underway, is a function of the State agency. This is their traditional function and one which the State agencies can handle best.

MR. TAYLOR: Mr. Stein, before we close, I would like to say, on behalf of some of us at least, and I think probably all, that we think that you have conducted this conference very well. Please assure the Secretary of Health, Education, and Welfare that we in New England will do our best to provide him with a suitable quality of interstate water.

MR. STEIN: Thank you.

Mr. Shea, do you have anything to say?

MR. SHEA: I have no closing statement.

MR. STEIN: All right.

Closing Statement - Mr. Stein

Thank you all for coming.

We stand adjourned.

(Whereupon, at 5:30 p.m., the conference was adjourned.)